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Advertisement Index, see page xx.

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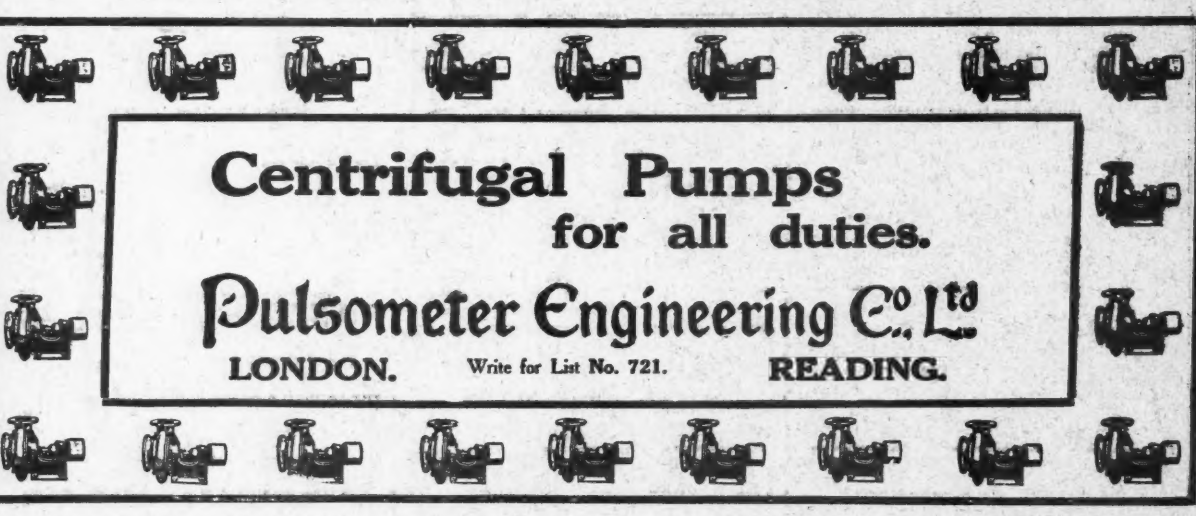

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Vol. LXXVIII.] CONTENTS: April 21, 1916. [No. 2,004.

	Page
National Electricity Supply	441
Copper	442
Water for Condensing Purposes	442
The Wire-drawing Industries	443
Hydro-electric Power in Tasmania	443
An 11,000-volt Submarine Cable (*illus.*)	443
A large Battery Sub-station (*illus.*)	444
The Electricity Supply of Great Britain	447
The Business Side of Science	449
Correspondence—	
The Institution of Electrical Engineers	450
Decimal Coinage and the Metric System	450
War Items	450
New Electrical Devices, Fittings and Plant (*illus.*)	452
Legal	453
Ideas and Action	454
The Selling Side of Electricity Supply.—VI.	455
Business Notes	456
Sensitive Relay for Wireless Telegraphy	458
Notes	459
City Notes	461
Stocks and Shares	462
Electricity in Mines	463
The Efficiency of Labour, by E. E. Hoadley	464
Switch Control for Automobiles	465
Reviews	465
Ignition Magnetos (*illus.*)	467
Foreign and Colonial Tariffs on Electrical Goods	468
New Patents Applied for, 1916	468
Abstracts of Published Specifications	468
Contractors' Column	Advertisement page xviii

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NATIONAL ELECTRICITY SUPPLY.

THIS subject formed the text of an interesting discussion which took place at the Institution of Electrical Engineers last week, and is reported elsewhere in this issue. The theme is by no means a new one in electrical circles, but Mr. E. T. Williams, who was responsible for bringing the matter forward, has undoubtedly helped to focus our attention on a problem, the importance of which the events of the last twenty months have amply demonstrated.

The proposals put forward by Mr. Williams represent in the main the logical sequel to the insistent demands for conservation of our national fuel resources, and the no less pressing necessity of improving our industrial equipment with a view to securing the maximum of efficiency in industry after the war. The suggestion, for the purpose of discussion, is, briefly, that the control of the electricity supply of Great Britain should be vested in an Electricity Board, having the weight of Government authority, and that the area in question should be divided into sections, each with an engineer manager responsible for its electrical well-being, who would occupy a seat on the Board, together with legal, accounting, financial, and Parliamentary members—one of each. The other essentials of the scheme are the provision of a bulk supply network to connect the existing generating stations and new ones which may be added by the Board. It is important to note that interference with existing stations and the capital invested in them is not contemplated, and it is anticipated that the benefits to be derived from the mutual interchange of load via the proposed bulk supply network will eventually lead to the smaller and less favourably situated generating plants disappearing.

Stress is laid on the possibility of equipping on a large scale at once, and fully loading within a brief period, any new stations feeding into the proposed network, with resulting all-round efficiency; Mr. Williams might have gone further and emphasised the important fact that only by means of such a scheme can our generating engineers make up the enormous leeway which exists between present British practice, as regards the size of unit employed, and the largest and most efficient units which are commercially obtainable. We must, as Mr. Williams hints, be prepared to depart from "cut-and-dried" methods, and such a scheme would enable us to fit the load to the most efficient station in the neighbourhood—to rule out the present disturbing and efficiency-destroying factor of load variation in the most modern plants, and so to obtain the maximum efficiency from them at least.

Judging by the experience gained from the interlinking of the London power stations, and the progress made in that direction, it is more than probable that provincial areas will follow suit, thus forestalling in part the larger scheme.

It seems very doubtful, however, whether such partial methods of mutual assistance, especially if dependent on local initiative, can take the place of a co-ordinated general scheme, although this was suggested by Mr. Merz. The tendency would be to super-develop certain supply areas which are already being developed, but the small towns, the villages, and the farms would be no better off than they are at present.

We regard it as essential that electricity supply shall be brought within reach of the agricultural

industry at the earliest possible moment; in farming, as in other directions, the methods of the past will not serve, and there is every reason to believe that those of the future will be largely electrical, if we choose to make them so. Possibly the Board of Agriculture might be disposed to lend its aid to such a scheme, in view of the serious position which has arisen in connection with that industry, and to which Lord Selborne drew attention in the House of Lords last week. It seems likely that difficulty would arise in connection with the financing of a scheme of this nature unless its national character led to some form of Government guarantee being given; but our ideas on most things are undergoing revision, and it would seem scarcely consistent, after spending five millions a day for many months on war, to quibble about the expenditure of a few millions a year for two or three years on an epoch-making industrial development, as some people are disposed to do, because an immediate return on the money might not be visible.

If it is conceded that a supply of cheap electricity is likely to be a factor—and we believe it to be an essential factor—in our future commercial prosperity as a nation, then we must fearlessly accept the condition, put forward by Mr. Chattock, that no direct financial return should be expected for some years, but that the country should shoulder the loss in the meantime—if, indeed, that can be called loss which confers so many indirect benefits on a nation, and which holds the certainty of ample returns in years to come.

The electrical manufacturing industry in this country has been held back for years by our unenterprising and inelastic methods of electricity supply; but were it assured of the enormous home demand which would result from the supply of electricity on a wholesale scale in this country, its operations abroad could also be conducted with the same facility and success as those of its great rivals, in so far as these are due to their manufacturing resources.

Clearly the matter is one deserving of the closest consideration at the present time; so many interests are involved, however, and many of them of a non-electrical character, that it will be necessary to enter on a campaign of general enlightenment in order to obtain the needful support—we must, in fact, talk hard and keep on talking, if we are to attract public attention and arouse enthusiasm. In this connection Mr. Roles's suggestion as to enlisting the support of the chief engineers of existing undertakings, by giving suitable guarantees that they shall not be displaced, is worth consideration; we believe that engineers and managers would be in increased demand rather than otherwise under such a scheme, and that public servants have, as a rule, little to complain of in the matter of compensation, &c., when they relinquish a post to please the public, but it appears to be an easy way of securing five or six hundred missionaries, who would necessarily bring influence to bear on the various public bodies, and thus possibly enlist the services of some of the most prolific talkers in the kingdom in aid of the scheme.

Copper.

Recent vague indications of a falling off in the general demand for copper, possibly under the influence of the more hopeful views that were entertained as to the duration of the war, have proved rather deceptive. The abstention of buying, indeed, has been only temporary, as it was to some extent due to the opinion expressed by certain American critics that prices had been forced up to a point as high as could be reasonably expected even under the more stringent conditions. There was certainly a little more inclination on the part of a few smaller American producers to consider lower offers for forward shipment, but this change of sentiment has not exerted the least influence on the arbitrary attitude of the big American producing interests, who latterly have been more sparing in their offers for forward deliveries owing to another extension of buying, first by our Continental Allies, and subsequently on the part of American consumers, whose takings within the last few months have grown at a stupendous rate. Prices for distant shipment have certainly stiffened to a notable extent. The serious scarcity encountered in covering needs over the Spring now looks like spreading over the whole of the summer months, for which period extensive orders have apparently already been placed, which leaves the copper magnates in absolute command of the situation for an indefinite period, or so long as the chronic scarcity of spot metal continues. European stocks are virtually exhausted, as shown by the statistics, and there is no prospect of a replenishment for some time at any rate. Fairly liberal shipments are, it is true, pretty regularly made to this side from American Atlantic ports, but the whole of this copper is already sold, and the great bulk thereof goes straight into the hands of munition manufacturers, whose operations are in full swing at this critical stage of the great struggle. Never before in the history of the copper market has the demand for the metal been so extensive and so urgent. There has been for some time past a phenomenal wave of industrial activity across the Atlantic, in addition to which munition work on a considerable scale is apparently now being carried on in the United States as a precautionary measure. The world's production of copper has now by far eclipsed all previous records, but the extension of requirements has been no less marked, and this must be expected to continue for months to come, so that anything like a retrograde movement in prices is rather unlikely, unless unexpected developments arise in the war situation, calculated to hasten a conclusion of hostilities. The fact is worth noting that in spite of an absence of speculation in warrant copper under the Government prohibition, prices have steadily broken into new high records, owing to the famine conditions. The price has in the past week risen to about £126, and offers are as scarce as ever.

Water for Condensing Purposes.

The question whether a manufacturer can lawfully take water from a river for the purpose of condensing steam is one which is of increasing importance, having regard to the rising price of coal. There are few cases on the subject; and such cases as there are do not cover many of the important points. For instance, suppose a riparian owner has a mill which is worked by water power derived from the stream. He will naturally want all the water he can get to flow into his mill dam. Then suppose that another owner, a little higher up, takes water from the stream, uses it for condensing, and returns it, undiminished in quantity, below the dam. Has the mill owner any right of action? The authorities clearly establish certain propositions. In the first place, a riparian owner may take water from a stream for all ordinary purposes, *e.g.*, domestic purposes, supplying cattle, watering his garden, and even for irrigation. He cannot, however, draw off water and sell it to a water company for supplying a town. In the second place, every riparian owner may divert the water of a stream for purposes in connection with his land or for other purposes; but he is bound to return the water which he has diverted into the stream again before it leaves his land, substantially undiminished in volume and unaltered in character; for a lower riparian owner, subject to the rights of an upper owner, is entitled to have the water flowing in the natural bed of the stream come to him unaltered in quality and quantity, and to come to his land in its ordinary and accustomed channel. There is no case which holds that a man may abstract water for con-

densing purposes and return it undiminished in quantity or quality lower down. Indeed, such a decision would appear to be contrary to the principle above enunciated. Where, however, he takes water for condensing, and returns it to the stream substantially at the same point on his own land, it has been held that he does not infringe the rights of the lower riparian owners (see Kensit *v.* Great Eastern Railway, 27 Ch. D. 122). All persons taking water for condensing purposes would therefore do wisely to see that it is returned to the river on their own land.

The Wire-Drawing Industries.

The increasing difficulties experienced by wire manufacturers in obtaining supplies of copper for rolling and drawing down, and the holding back of trade inquiries, in consequence of the abnormally high price ruling in the metal market, have resulted, during the past few weeks, in a decline in the output of many of the leading firms in this country. This, in some measure, is to be regretted, as, with fewer restrictions in obtaining shipment of goods, more attention could be devoted to the important question of the development of the oversea trade, a section which in the near future should prove to possess many attractive and promising features for enterprising firms.

In the home trade section, however, there is probably much yet to be done in the direction of preventing a repetition after the war of the German wire manufacturers' acquisition of trade in these markets with the same successful results as hitherto. It cannot be too often repeated that the basis of the German wire manufacturers' success in this country, and in the British markets overseas, has been a thorough and comprehensive system of personal representation. This fact, besides being now more than ever fully appreciated by British firms, has been vouched for in confidence on more than one occasion during the past few years by successful Germans themselves, who have made good in these markets with practically no opposition as regards being first in the field. Moreover, influential buyers in the cable and electrical industries in this country have confessed of late that frequently in the past the attractions and inducements to trade with German firms, in preference to British firms, have been due, not so much as has often been erroneously supposed, to undercutting in price and cheaper production, as to superior all-round attention in the matter of personal representation by qualified men.

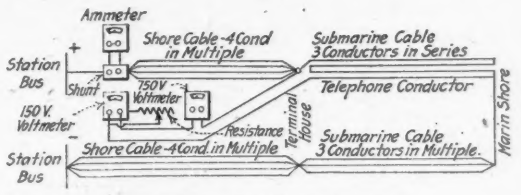
Hydro-Electric Power in Tasmania.

Operations that are in progress in Tasmania along hydro-electric lines are already more or less familiar to our readers, but Mr. C. T. Milne, H.M. Trade Commissioner in Australia, has recently reported on this matter, as mentioned here a few weeks ago, he having been in Tasmania at the end of last year. In order to bring the scheme to the notice of Australian manufacturers and other light and power users, the Government is carrying out a publicity campaign, and has, it is believed, made arrangements for the sale of about 9,000 H.P. Works are being projected, and apparently United Kingdom interests are investigating the possibility of erecting woollen mills. The general manager, in an interview with Mr. Milne, stated that there would be an increased demand in Tasmania for electrical fittings and appliances, and he suggested that the time was ripe for more active steps to be taken by our manufacturers of such goods to bring them to the notice of consumers. Firms in the United Kingdom can secure information regarding reliable firms in Tasmania who would be ready to undertake their representation, from Mr. Ashbolt, the Imperial Trade Correspondent, at 23, Old Wharf, Hobart, Tasmania.

AN 11,000-VOLT SUBMARINE CABLE.

The city of San Francisco is situated on the southern shore of the Golden Gate, the narrow entrance to the land-locked San Francisco and San Pablo Bays. Until recently, hydro-electric power has been supplied to the city from the Pacific Gas & Electric Co.'s power plants by a roundabout route extending from Cordelia sub-station, round the southern extremity of San Francisco Bay, and along the shore to the Martin station at San Francisco, a distance of 107 miles.

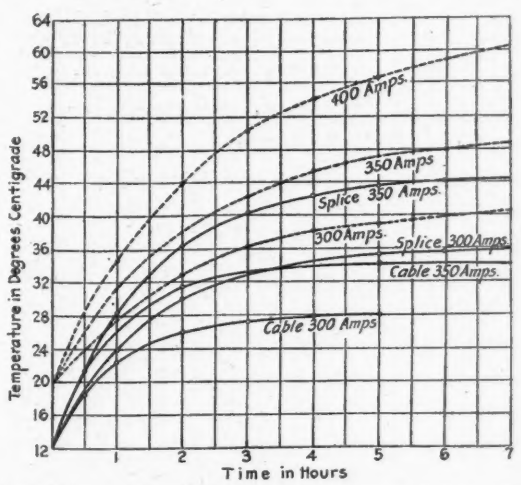
As the hydro-electric plants to the northward increased in number, it was considered desirable to provide a more direct supply route, as the San Francisco steam stations could then more readily serve as relays for the rest of the system. Quite recently a pair of cables were laid across the water from Oakland on the other side of the bay, which somewhat relieved the situation, but still left much to be desired, and in May, last year, it was therefore decided to make use of the 60,000-volt line from Cordelia to San Rafael, by constructing a connecting line to Sansalito, where a step-down sub-station has been erected; to connect this by means of a short pole line with the northern shore of the Golden Gate, and to lay two submarine cables across the latter, a distance of 13,000 ft., to the southern shore, and from a cable terminal house on the latter to lay four underground cables, a distance of 6,500 ft. to couple up to sub-station F of the San Francisco system.



Connections for Cable Testing.

The installation was designed to deliver 18,000 H.P. at a pressure of 11,000 volts, which is the H.T. distribution pressure at San Francisco.

The cables were laid across the "forbidden anchorage" area between the two shores, as the best route; consideration had to be given to the 6-knot tide, to the depth of water, which exceeded 200 ft., and to the question of repairs subsequently,



Temperature Curves—Solid for Submarine Cables and Dotted for Shore Ends.

as the strain on the cable itself when lifted from a 200-ft. depth would be excessive.

It was therefore decided to use the messenger cable method of laying, in which a steel rope is laid from shore to shore and securely anchored, and acts as a guide line in laying the power cable. The messenger cable is picked up at the shore end and laid across a barge on which power cable reels are mounted; the former cable passes over sheaves and through a cable gripper in charge of an operator, who controls the movement of the barge while it is being towed across the water by a launch.

The power cable was attached to the messenger before paying out, and after a length of cable was laid, the barge was anchored to the messenger and another length spliced on, the four reels of cable carried representing about 5,000 ft. of cable.

The free end of the cable was then sealed and lowered overboard, the barge towed to shore (under-running the messenger), and reloaded with cable. The messenger was then picked up at the free shore end, laid across the barge, and under-run until the free end of the cable was recovered, when the

splicing and laying were repeated as before. The messenger cable takes the strain, relieving the cable and joints from all tension.

The steel messenger cables are 1¾ in. in diameter, each composed of 37 strands of galvanised steel wire, woven in one length of 14,000 ft. and having a breaking strength of 90 tons.

Each of the power cables consists of three stranded copper conductors, having an area of 350,000 circ. mil. at the shore ends and 250,000 circ. mil. for the deep-water sections; this represents a finished diameter of 4½ in. and weight of 22 lb. per foot in the former case, and a finished diameter of 4 in. and weight of 19 lb. per foot in the latter.

The conductors are insulated with rubber and varnished cambric, and enclosed in a 5/32 in. lead sheath; over this two layers of jute were applied to form a cushion for steel wire armouring, and the latter was in turn jute covered, and a final coating of sand and asphaltum applied for mechanical protection. Each cable contains a twisted pair of telephone wires, cambric insulated, cotton braided, and laid in the jute filler between the main conductors of the cable. These telephone wires are protected at the shore ends by telephone insulating transformers.

The cable-laying barge was 70 ft. long and 30 ft. wide, and of 125 tons capacity; for laying the messenger cable it was towed across the tide, but for laying the power cable it was towed sideways to minimise interference of the tide, a 50-H.P. launch being usually employed.

On the barge itself the messenger was laid across a 40-in. sheave on either side of the deck, a rigging preventing it from leaving the sheaves no matter what position the barge might take up. The power cable was fed from the reels round spools, and both it and the messenger were passed through a serving machine, driven by a petrol engine; this machine was used to bind the two cables together by a continuous winding of two galvanised wires, but every 20 ft. the movement of the barge was stopped by the grip, and a number of turns wound on at one point, in order to ensure connection at 20 ft. intervals. The speed when laying the cable was 8 ft. per minute.

To make the joint mechanically strong it was necessary to lap the armour about 15 ft., which involved cutting off 15 ft. of the cable projecting from the water; the armour was folded back and held in shape by rings.

The copper conductors were sweated together and insulated with rubber and cambric; the telephone conductors were spliced and insulated, the twisted pair being transposed between cores at each joint; finally, a 4½-in. lead sleeve was wiped to the main sheath, and the joint filled with "ozite" poured in at a temperature of about 460 deg. F., sealed, and lapped, and the armouring put back into place.

As the barge was held fast to the messenger during jointing operations, the serving machine was mounted on rollers, so that it could travel along while binding the wire over the joint. Every 12 in. the serving wires were soldered together to provide against unwrapping should the wire break.

The cable was not attached to the messenger for a distance of 8 ft. on each side of a splice, to allow it freedom of movement independent of the splice. There were 11 splices in each completed cable.

After the final splice was made, the cable and messenger were under-run to a point mid-way between two splices, when both were hoisted off the reels and lowered to the bottom by ropes.

Cable laying was commenced on September 26th, and the two cables were laid and tested by October 30th, the connection through to San Francisco being completed on November 5th.

Continuous megger tests were carried out during laying from the sub-station on the north shore, and full 22,000-volt tests were made on the splices.

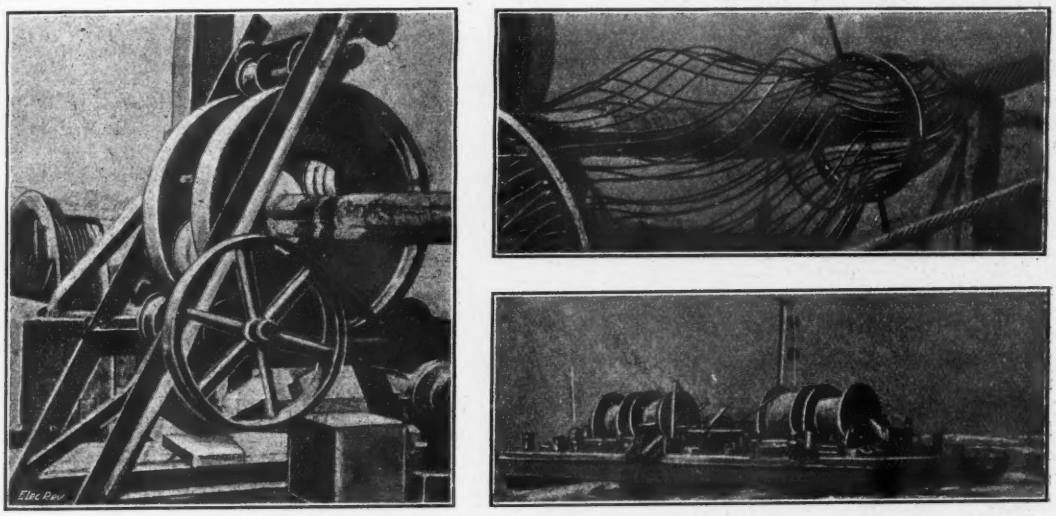
The opportunity was also taken to carry out heating tests on the submarine cables, on which little data has previously been available.

By means of a 650-volt 1,000-KW. direct-current generator and by connecting the cables, as shown, diagrammatically, it was possible to circulate current through the conductors of the submarine cable.

The telephone wires in the cable and on the San Francisco shore were used as pressure cables, and it was possible to determine the voltage drop for any given load. From observations the temperature curves shown on page 443 were plotted, the water temperature being 12 deg. C. Laboratory tests under similar conditions were arranged to determine the temperature rise in the splices, for which also curves are shown.

The shore ends of 350,000 circ. mil. cable are not entirely under water, and further tests were made on these cables, the dotted curves showing the temperature rise. As the life of the rubber insulation depends largely on the temperature to which it is subjected, it can be seen that the safe carrying capacity of the cables is approximately 350 amp., owing largely to the radiating capacity of the splices and the large size of the shore ends, although under emergency conditions the cables could safely carry 400 amp. The specification called for a test pressure of 30,000 volts for 30 minutes at 60 cycles between conductors and between conductors and ground at the factory. The telephone conductors were to withstand a pressure of 4,500 volts between conductors and between conductors and ground. On test it required 100,000 volts to puncture between conductors of the main cable and 46,000 volts between the conductors of the telephone cable.

In conclusion, we have drawn on articles recently appearing in the *Electrical World* and *Journal of Electricity* for much of the information here given.



BARGE SERVING MACHINE, RINGS TO HOLD ARMOURING DURING SPLICING, AND VIEW OF BARGE.

A LARGE BATTERY SUB-STATION.

THE Metropolitan Electricity Supply Co. have recently completed a large battery sub-station in Eagle Street, Holborn, in order to increase the facilities for supply in that district. Provision is made in the building for four complete batteries, and one of these has been installed in the basement; it has been supplied by the Chloride Electric Storage Co., Ltd. The battery consists of 110 cells of their O.V.W. 26 type accumulator, in lead-lined pitch-pine boxes, and has a capacity of:—

1,200 amps.	for 10 hours	to 1.8 volts per cell	= 12,000 A.H.
2,000 amps.	for 5 hours	to 1.78 volts per cell	= 10,000 A.H.
3,800 amps.	for 2 hours	to 1.7 volts per cell	= 7,600 A.H.
6,000 amps.	for 1 hour	to 1.65 volts per cell	= 6,000 A.H.
8,000 amps.	for 35 minutes.		
12,000 amps.	for 1 minute.		
15,000 amps.	momentarily.		

The normal maximum charging rate of the battery is 1,400 amps., and the maximum continuous charging rate 2,570 amps. The maximum charging voltage is 2.6 volts per cell.

The positive plates are of a special Planté type, in which the active material is in the form of pure lead rosettes, supported in a strong and rigid antimonial lead framework, which is unaffected by the chemical changes which take place during the life of the cells and retains its strength. The negative plates are of the cage type, each plate consisting of an antimonial lead cage in two halves riveted together; the face of the plate presents a smooth surface of perforated sheet lead,

the intervening pockets constituting receptacles for the active material. The plates are separated by wooden dowels, which also act as supports to special wood diaphragm separators, and are held in the correct position by means of india-rubber rings. The plates are suspended on stout glass slabs, resting on and held in position by lead shoes. The positive and negative plates in adjoining cells are connected by means of massive channel bars. The efficiencies guaranteed are: amp.-hour efficiency at all rates, 90 per cent. Watt-hour efficiency, 75 per cent. at 5-hr. rate; 72 per cent. at 2-hr. rate; 70 per cent. at 1-hr. rate. There are 26 positive and 27 negative plates in each cell, the former 7/16 in. thick and the latter 5/16 in. thick; both plates measure about 16⅛ × 46⅜ in. The overall dimensions of one cell are 21¾ in. × 49½ in. × 65½ in., the height overall being 68½ in. Sections of the cell are given in fig. 5.

The weight of the positive plate is 90 lb., and of the negative 41 lb., except the outside plates, which weigh 34 lb. each; the total weight of the plates in one cell is 3,452 lb., of the acid 1,700 lb., and of the complete cell 6,080 lb. The approximate weight of the complete battery, exclusive of the stands, is 298½ tons. Each cell is supported on 12 glass insulators of the "mushroom" type. The stands are of pitch-pine, and are supported on strong glazed earthenware insulators. The different rows of cells are connected together by means of flat copper bars bolted to copper take-offs, cast into the channel bars at the ends of the cells; each connection is composed of four bars, each 4 in. × ¼ in., air spaces being left between the bars. These bars are suspended from the ceiling by means of iron rods, insulated from the copper by globe strains and insulated turnbuckles.

The battery-room floor is of special construction (see fig. 6); metalline bricks are laid on edge, in rows of sufficient width to carry the glazed earthenware insulators for supporting the battery stands in grout; the rows are 9 in. wide, and stand directly on the cement screed of a concrete floor. A space of about ¼ in. is left between the bricks, and is filled in with cement to a depth of about 1 in. from the bottom of the bricks. Acid-proof asphalt compound 1 in. in thickness is laid over the whole of the cement finish to floor; a fillet is formed

Fig. 1.—Part of Chloride 1,320-kw. Battery.

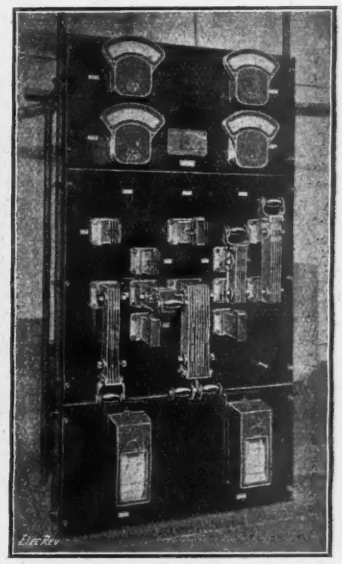


Fig. 2.—Negative Switchboard.

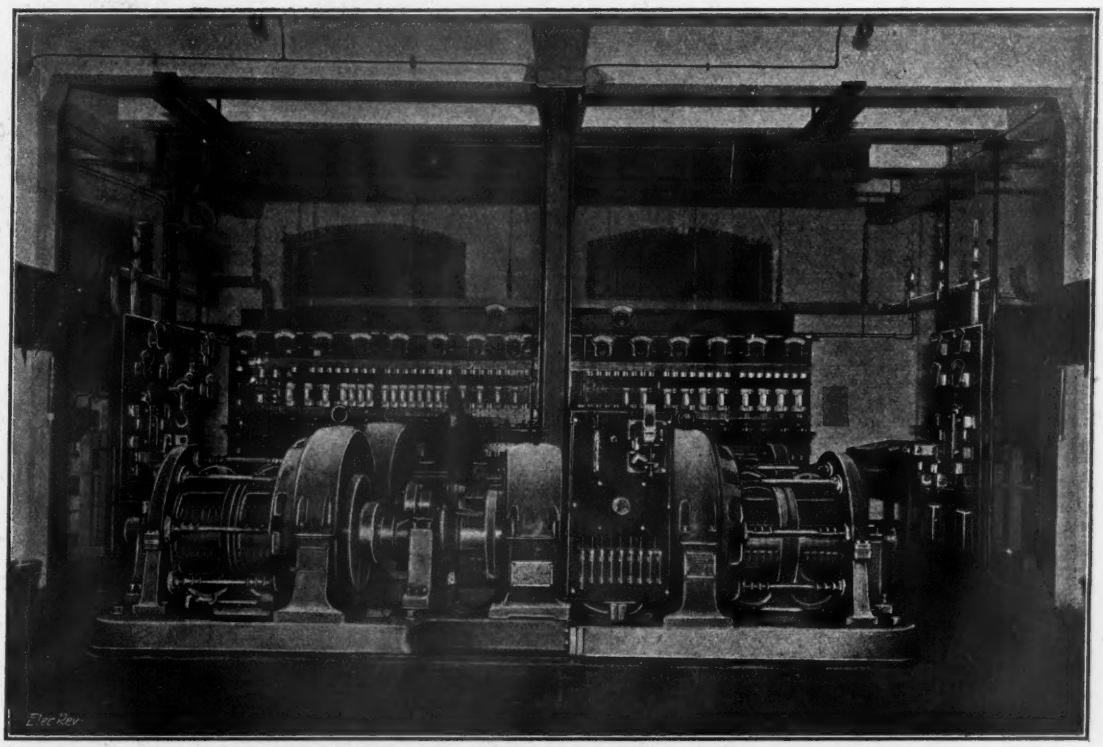


Fig. 3.—E.C.C. Boosters and B.T.H. Switchgear.

round the bricks to 1¼ in. above the level of the surrounding asphalt, and is ironed against the rough surface of the bricks. The ¼ in. spaces between the bricks are also filled with this compound to the level of the top face and sides of bricks, thus forming an acid-proof floor and making a solid foundation for the batteries, which are illustrated in figs. 1 and 4.

Two motor-driven boosters have been installed to deal with the present battery; they were supplied by the Electric Construction Co., Ltd., of Wolverhampton. Each consists of one interpole motor of 115 B.H.P., at 210/240 volts, 500 R.P.M., and two interpole boosters, the fields of which can be reversed

FIG. 4.—PART OF BATTERY.

so as to boost up or down; each booster is capable of giving 1,800 amps. at 16.7 volts continuously, 2,500 amps. at 12 volts for two hours, and 3,000 amps. at 10 volts for one hour. The boosters are separately excited at 210/240 volts, and each has a single commutator, which is ventilated through slots in the centre of the commutator between two steel rings, as shown in fig. 3. The machines, which are connected by Zodel-Voith flexible couplings, have four bearings on one combination bedplate, and are fitted with carbon brushes.

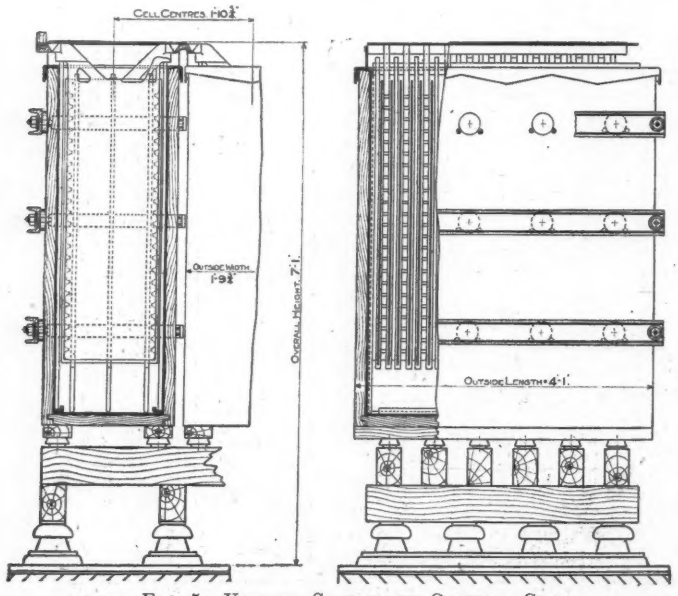


FIG. 5.—VERTICAL SECTIONS OF CHLORIDE CELL.

The efficiencies of each booster under the loads given above are respectively 69, 62, and 56 per cent. The efficiency of the motor is 91 per cent., with each booster giving 30 KW.

The switchgear for each motor is mounted on a panel fixed to the bedplate of the machine. The starting switch consists of nine interlocked slow-break knife switches, and the booster field regulators are of the pedestal potentiometer type. The boosters are shown in fig. 3.

A battery milking booster made by the Electric Construction Co. has also been installed, consisting of an interpole motor driving an interpole booster, which gives 1,500 amps. at 10 volts, 575 R.P.M. It is provided with four bearings and mounted upon a combination bedplate, together with the necessary switchgear. The booster is connected up to copper bars supported by globe strains under the ceiling of the basement as shown in fig. 1. Portable flexible leads are used for the connections from these bars to the cells.

The switchgear, which was supplied by the British Thomson-Houston Co., Ltd., consists of one main board for feeders, motors, and battery, one negative and battery panel, one positive and battery panel, and one instrument panel.

The main switchboard, shown in fig. 3, accommodates the battery connections, field and motor connections, and 24 triple-concentric feeders. It consists of six feeder panels, one motor and battery panel, and one panel carrying four 4,000-amp. switches for dividing the feeders into two sections, the neutral bar having a covering plate for this purpose. There are double positive and negative copper bus-bars, so arranged that feeders or battery and motors can be connected to either the top or bottom bus-bar, the battery through two 4,000-amp. switches in parallel on either pole, and the motors and feeders through switch fuses, each feeder having two fuses in parallel.

Twelve of the company's feeders forming part of the network in Eagle Street were cut, both ends of each feeder being brought into the station and connected to the bus-bars through neighbouring fuses. The feeders can, therefore, be boosted up as required, and the battery current is available in the feeders in either or both directions.

The negative and positive booster and battery switchboards

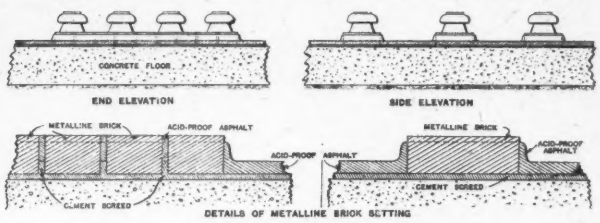


FIG. 6.—DETAILS OF FLOORING.

are at opposite sides of the machine room, as shown in fig. 3. The negative switchboard is shown in fig. 2. Mounted on it are two 5,000-amp. switches for No. 1 booster, two 5,000-amp. switches for No. 2 booster, and one 8,000-amp. switch for the battery connection, four voltmeters, one recording voltmeter, and one recording ammeter. The switches on the positive board are similar to those on the negative panel, the instruments being two voltmeters, one ammeter, and one charge and discharge Aron watt-hour meter. These switchboards are

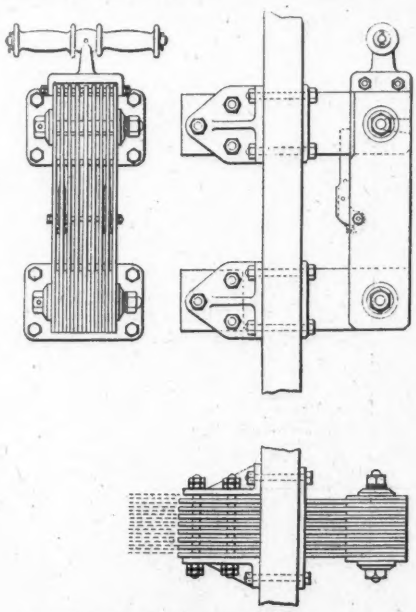


FIG. 7.—8,000-AMP. SWITCH.

arranged so that either the first or the second machine, or the two in parallel, can be connected to the existing battery or to a second battery. An instrument panel carrying five ammeters is fixed by the side of the positive panel.

The basement is ventilated by means of two fans, belt-driven from a motor. One is a low-pressure fan drawing air from outside, and discharging it into the basement through wooden trunks situated on the floor, and carried nearly the full length of the building at either side; a portion of one of these trunks is shown in fig. 1. The other is a high-pressure fan drawing air through a wooden trunk fixed to the ceiling

of the basement, and discharging at the top of the building; a portion of this trunk is shown in figs. 1 and 4.

The building consists of a basement, ground, first, and second floors. The basement and ground floor were designed to carry each two batteries similar to the one now installed. The first floor was designed to carry all the boosters required for the four batteries, and also the necessary switchgear. For the present, however, the boosters and switchgear are erected on the ground floor, thus saving a considerable amount of copper.

The contractors for the building were Messrs. Geo. Andrews and Co. The steelwork was supplied by Messrs. Drew, Bear, Perks & Co., the architect being Mr. J. W. Stanley Burmester. The building and plant were erected under the supervision of the Metropolitan Electric Supply Co.'s engineers, to whom we are indebted for the foregoing particulars.

THE ELECTRICITY SUPPLY OF GREAT BRITAIN.

An important discussion took place last week at the Institution of Electrical Engineers on this subject. It was introduced by Mr. Ernest T. Williams, M.I.E.E., who in January submitted a paper dealing comprehensively with the present state of the electricity supply industry; the new conditions brought about by the war, and the urgent need for electrical engineers to work together for meeting the country's need for a cheaper and more extensive electricity supply; and a proposed scheme to meet this need.

The Council's decision to hold a general discussion on this subject made it desirable to reduce considerably the ground covered by the introductory paper, and for this reason the first two sections have been almost entirely deleted.

Mr. Williams pointed out that the time had now arrived when we must think of the supply industry not as a large number of independent detached schemes having separate areas, but for the country as a whole. If the policy of centralising generating plants in larger power stations had been economically sound, even though this involved transformation losses and additional mains, why should they hesitate in taking the next logical step of considering the eventual replacement of the large number of small, costly, comparatively inefficient electric supply stations by a few modern interconnected power stations for dealing with the electricity supply of the country as a whole?

Such a method of dealing with the problem would result in lower capital costs per unit of output and lower working costs per unit generated.

Against this must be set the increased cost of bulk distribution mains and transforming plant, and the loss in efficiency due to the transformation.

The area of Great Britain was comparatively small, but no country offered so great promise for a sound and economical electricity supply, if taken as a whole.

Technical considerations offered little difficulty, and financial issues could be dealt with under the guidance of present experience and knowledge. It was the basis of organisation which most urgently demanded attention, and the author had endeavoured to evolve a scheme on which the organisation might be based. It was imperative that the scheme should be formulated to draw in existing interests instead of acting in direct opposition to them.

The public control of electricity supply should be co-ordinated by a central body directly responsible to Parliament. Such a body should not be an existing Government department having various other interests; it should not be a Government department at all in the accepted sense of the word. At the same time, this central body must have all the weight of Government authority and be able to authorise or raise big loans on Government security at low rates of interest.

Such a body would have to be created with the necessary powers under a special Act of Parliament. It could be designated the Electricity Board, and its purpose would be the co-ordination, control, and development of the electricity supply of the whole kingdom for the public good.

He would assume that the whole country of Great Britain was divided into, say, six sections; an electrical engineer manager would be appointed for each district, where he would reside in a central position. On him would devolve primarily the responsibility of seeing that the best interests of the electricity supply for the public good were being developed and maintained, and in him would be co-ordinated the various electrical interests of the district, and the management of such portion of the electricity supply as might be directly handled by the Electricity Board.

One of the most interesting examples of a new quasi Government department was that of the Public Trustee, whose great and rapid success proved the value of having a faithful and sympathetic public servant available for certain purposes. The electrical engineer managers would act in a similar way in their own districts, whose electrical well-being would be their primary interest and endeavour, and these gentlemen holding well-paid and authoritative positions would be members of the Electricity Board and take part in all its deliberations.

Such public boards to be most efficient should be kept as small in size as possible. It was, however, desirable that they should be self-contained and fully representative of the departments of the Board—legal, accounting, financial, and Parliamentary. The heads of these four departments, like the electrical engineer managers, should be men of authority and repute in their several professions, so that the Board, constituted of these ten and two other members, would represent an efficient and responsible body of high permanent officials and recognised experts.

The President of the Board should be a man of wide knowledge and experience in public affairs, whose name carried weight and inspired confidence in the public and men of affairs. Like the other members, he should preferably be a paid official and expected to devote most of his time and interests to the work of the Board. Finally, the Board would have its permanent secretary, in whom—under the president—the organisation would be centralised.

To the Electricity Board proposed in the foregoing clauses all the questions relating to the electricity supply of Great Britain would be referred. It would become the authority—under Act of Parliament—on all the various questions and issues involved in the supply and application of electricity. Matters now dealt with by the Home Office, the Board of Trade, the Local Government Board, and by Parliament itself, would be gathered together under its control. The only reservation would be the right of appeal from the Board's decisions to the higher authority of Parliament.

Never before in the history of this country had it been so evident that they must conserve their capital and resources. Thus to launch forth on to theoretical considerations of the generation of electricity without using to the utmost the present sources of supply would be to court failure.

The suggested scheme would, therefore, at the outset interfere with present generating stations to the minimum extent. When, however, stations under municipal control reached the limit of their capacity, or desired to replace their obsolete plant, they would require to obtain the Board's authority for the expenditure. It would then be for the Board to decide in each case whether the interests of the district and of the electricity supply of the country as a whole would best be served by allowing such additional plant to be purchased by the Corporation and installed in the generating stations, or whether it would be better for the additional load to be supplied in bulk from a bulk network.

It would be for consideration whether limited companies should be brought compulsorily under this ruling or not, for they were placed under different conditions from municipalities and generally would prefer to purchase their current in bulk, if by so doing they could obtain it at a lower cost, than to sink further capital in their existing generating stations.

Several large stations in the country were highly efficient, modern, and capable of extension in large units; these would be the initial ones in the greater scheme which would be planned in order to embrace them. They would be interconnected by a bulk-supply network, to which they would supply their surplus power. Though additional new stations would be required from time to time as the demand increased, and it would probably be preferred for such stations to be erected and worked directly under the Board, it by no means followed that the control of the existing power stations which it might be decided to incorporate in the scheme should pass out of the hands of the present authorities, whether municipal or company owned.

Waste blast-furnace gas, surplus water power, and other sources of energy would be utilised.

The lower the price at which they could supply electrical energy, the greater would be the demand, and, conversely, the greater the demand the lower the cost at which they could supply. The result was thus cumulative, and if the cost could be brought low enough the demand would be so great as absolutely to dwarf the present load. The two chief items of generating cost at present were the capital charges and fuel, and it was very evident that under favourable conditions and with a sufficient demand these could be reduced to a small fraction of the present average generation costs throughout the country. With the diversity factor of such a demand the load factor on the stations would be high, and the plant factor, or proportion of time the plant when running was on full load, would be almost unity; this would be brought about by the interconnection of the stations.

The scheme would enable much greater freedom of departure from "cut-and-dried" methods to be embarked upon, due to the fact that a station could be laid out and built on a large scale at once, for, if it was to feed into a network to supply the whole country with a rapidly growing demand, the time would be comparatively short before the station would be required to give its full output. Thus early utilisation of the capital sunk in the station would remove one of the disabilities under which the designer of an ordinary large power station now laboured. More important, however, would be the fact that the failure of any new departure to obtain fully the anticipated results would not be the same serious matter which a similar partly successful experiment would be in an ordinary power scheme to-day. This was important, for development must be progressive.

A number of the stations would probably be arranged for running on gas-fired boilers with modern plant for the recovery of the by-products of the fuel in large quantities, and near such stations would probably be established chemical

production companies making large demands for electrical energy for electrochemical processes.

The main bulk-supply network should be the property of the Board, which would have the right to carry its overhead or underground mains through any district. The subsidiary network might belong either to the Board or to existing undertakers, according to circumstances; for example, there appeared no reason why the power companies and the large municipal undertakings should not themselves supply current in bulk on their own mains, taking the supply from their own power stations, from the Board's bulk network, or from both.

The bulk network would have to be designed with a view to ensuring reliability of supply, so that if any one power station failed it would not affect the main supply, or if any one section of the bulk network was destroyed the supply of current would go on automatically to the subsidiary network. Reliability of supply was of the utmost importance, taking the premier place even before low cost. One of the strongest arguments for the new scheme would be its greater reliability, owing to the number of stations and the alternative routes of cables.

The question of giving a supply in any part of the country would require to be regarded not alone from the standpoint of whether it would pay to run the electric mains for the immediate demand, but also from the larger standpoint of whether giving such supply was for the good of the country as a whole. In this way many districts would be given a cheap supply of electricity, which under the ordinary commercial conditions of a company operating in a smaller area would not obtain.

The transformation and distribution of electricity to the small and medium-size consumer was well and efficiently filled by the present undertakings, and, with the exception of removing a few anomalies and arranging for developments to be on lines which would tend to greater uniformity throughout the country, the scheme would not interfere with the present arrangements. If those interested in the existing undertakings could clearly see that the scheme would not be detrimental to them, but otherwise, it would readily receive their support.

By leaving the local distribution under local control, the inter-departmental questions which arose, such as opening roads for laying mains, lighting roads, pumping water electrically, &c., would be more readily dealt with, and local control, whether municipal or company, would create a local interest in the question of electricity supply which would tend to its more rapid and favourable development.

In districts where there were no electricity supply authorities, the detail distribution would have to be carried out by the Board itself in order that no district in the country should be without its cheap electricity supply. This would not be a difficult matter, for undoubtedly under the new conditions all the railways, main line and suburban, would eventually be electrically operated, and this would carry the electricity supply wherever there was a railway, from which the supply would radiate to the country around. This desirable state of things would not be brought about in a day, and progress must go hand in hand with sound finance and common sense.

In the author's opinion, one of the indirect results of the scheme would be the resuscitation of our canal system. Hitherto, the question of electrical propulsion had been partly held back by the cost of the electric power system, but when power mains were running along canal routes for other purposes the problem would be simplified.

Similarly, the great agricultural interests of this country, which it was so important to revive, would receive a great stimulus from a cheap electricity supply. In other lands electricity was being largely adopted in agriculture; and much was to be gained by its aid for lighting, power, heating, and transport. Not only directly, but indirectly, must they assist agriculture by reducing the cost of artificial fertilisers, whether as by-products of generating stations worked with gas-fired boilers or through the cheap supply of current to electrochemical industries.

It was felt that the time was now ripe to launch this or a similar scheme on to the public notice. There was evidence on every side that men's minds were already actively employed in considering what could be done to enable the nation to support the burden brought about by the war. In what ways could the nation prevent waste and economise, and in what manner could production be increased? The electricity supply problem could play a leading part in both these departments, and because of this there had never been a more favourable time in which a united electrical profession could rapidly obtain public interest in and public support for its schemes.

There was too much said and written in these days which brought no results. Let them determine that it should not be so in this case.

When it was understood that these proposals could be brought into early operation by Act of Parliament without disturbing existing concerns, and that the policy of the proposed Board would be to become self-supporting at no distant date—ultimately neither requiring any financial assistance from the Exchequer nor operating for profit—it would probably receive the immediate support of all political parties, and a Bill could be rapidly passed through Parliament.

In a paper read before the International Engineering Congress, San Francisco, last summer, Mr. C. H. Mitchell demonstrated the wisdom and success of the policy of the Ontario Hydro-electric Commission. In this Commission was embodied, by Act of the Canadian Parliament, the control of the electricity supply of the Province of Ontario. Its aim was to enable electricity to be given at the cheapest rate to the people; and it supplied, without profit, electricity in bulk to various supply authorities, obtaining this supply largely from existing power companies and distributing it through the Commission's bulk supply mains. The costs of the Commission's operations were borne by the authorities to whom the supply was given. The formation of the Commission was considerably criticised. Its remarkable success spoke for itself, and should any further argument be necessary it would form a convincing one for the scheme herein outlined for Great Britain.

They should avoid large committees and voluminous reports, and by keeping the subject on concise and clear lines, and dealing with it in a businesslike manner, they would more readily attain their end.

It should be clearly understood that the proposed scheme was not for the nationalising of our electricity supply, nor was it for the municipalisation of that supply. Its true function was the co-ordination into one body of the control of the electricity supply, assisting existing undertakings whether municipal or company owned; and taking upon itself only those functions of generation and distribution which were essential to the furtherance of wise development and a supply at the lowest cost.

The scheme proposed no confiscation of the rights, privileges, and property of either electricity companies or municipalities, and in the event of its being recognised as essential in certain special cases to take any of these over, full compensation should be paid not only of the value of the actual plant, but of reasonable allowances for potential values.

The whole basis and policy of the organisation would be heartily to recognise what had been done by the existing authorities, whether public or private, and, instead of sweeping away, to conserve and build up, guiding future policy and co-operating with the present authorities for the well-being of the whole.

The author, having occupied responsible positions in Government, municipal, and private concerns, and having seen the inner workings of each, submitted the opinion that each had its proper sphere of action which it alone could best perform, and that the highest efficiency and greatest progress were only attained when these interests worked together in the common cause, none trying to usurp the place of the other, but all recognising that the success of the whole meant success of each in its own department.

The initial operations of the Board could be undertaken without huge financial operations, and the avoidance of drastic proposals for sweeping changes either in the ownership or control of existing undertakings would cause otherwise potential opponents to become adherents and advocates of the scheme, for all thinking men realised that something should and must be done to place the electricity supply of the country on a sounder basis.

Finally, these days of grave responsibility were also days of great privilege and opportunity. Never again would they find the same mental and moral attitude which was necessary to bring some such a scheme as here outlined to early fruition. Let it not be said of them that they failed.

Mr. C. H. Merz, who followed Mr. Williams, said he wished Dr. Ferranti had been there to take part in the proceedings, for he had no doubt as to the best arrangement for electric supply in Great Britain. It was worth while considering why the general idea outlined by Mr. Williams and others in the past had not made greater progress. Similar ideas had been proposed 20 years ago, and very numerous schemes of a similar character had been brought forward since, yet but little progress had been made, and he asked why. The author said organisation was the difficulty, but he (the speaker) differed. The reason, he suggested, was because the profession as a whole was not convinced that such a scheme was the ideal, and if that was so, they must face the fact and see whether the majority were right. They must make up their minds that what was right for other countries was not necessarily the right thing for this country. Argument was at a low level when it was urged that we must follow a certain course because another country did so; it was not the consideration which had influenced us in the past, and our aim should be to lead rather than to follow. As the electrical industry was not convinced, how was the question to be solved? The United Kingdom differed as regards its distribution problem from America and Germany, and they would be wrong in following the American idea of interconnected distribution areas. British areas were much more congested. The present war and general considerations had emphasised the importance of security of supply, and they had considerable areas solely dependent on one central station, which arrangement, if continued, would be likely to lead to trouble. The more these areas developed electrically, the greater the importance of not putting "all their eggs into one basket." As a remedy, such adjoining areas should be interconnected and worked conjointly, the linked stations being treated—as regards the size of generating units and proportion of spare plant—as one. Such an arrangement would lead to greatly reduced capital expenditure and improve operating conditions; he suggested that it was the only logical system on which electricity supply could be properly developed, and the most economical. With the larger units a coal economy of from 30 to 60 per cent. was

possible compared with what could be done with independent stations. Every day it was becoming more apparent that small stations could not adopt the refinements necessary to high economy. The most important result would be the improvement of load factor, and, as an instance of the possibilities in this direction, he cited the load curves of the North-East Coast system, which showed that they were able to get up to 60 per cent. The first step was for the technical side to agree as to the right lines of development; he discounted the idea of Parliamentary assistance, especially if they were not agreed amongst themselves. It was important that they should promote a "fashion" for electrical engineers to deal with their distributing systems exactly as they asked their consumers to deal with their own plants, &c.

Mr. R. A. Chattock said he was interested to see that Mr. Williams was covering similar ground to that covered by himself in his presidential address to the Municipal Electrical Association two years ago, and that he had further developed the idea. However, sufficient emphasis was not laid on the justification for such a scheme, which turned on the necessity of attracting the consumer, and involved a reduction in the cost of energy. It was well to help the idea by creating a fashion, but a much more powerful incentive would be found if the manufacturer's pocket benefited. Price was the great attraction to industry, which looked forward to future reductions, and they must stimulate the idea, towards which Mr. Williams's scheme would help. There was enormous scope for development yet, but the hampering influence was the large number of small stations and too high cost of operation of some of the large ones. A scheme of the kind suggested should be run on broad-minded principles, not so much to produce large profits and, possibly, with a loss in sight for some years. But the loss should fall on the community as a whole, as the scheme would benefit industry at large. The scheme put forward was the logical development of our present experience. He did not quite agree with the idea of not interfering with existing stations; if they were inefficient plants they should certainly be dispensed with at once, and each subsidiary area should be treated as if it were a substation area. Probably the number of large stations necessary would be quite considerable, and probably we should come to the interconnected station idea, with plants of, say, 300,000-kw. capacity each, as lowering the price of electricity would bring an enormous demand. He quite realised that a bulk supply network would be an expensive and difficult thing to arrange, and that a great difficulty would arise in connection with wayleaves, for which drastic powers would be required if the scheme were not to be crippled. There was no reason why such a scheme should not be prepared now in readiness for the opportunity to develop it.

Mr. J. S. Highfield said it was most important that they should come to some agreement on the subject, but when the previous speaker suggested that they must spend money and expect no return for some time, it reminded him of the dreadful times when electricity supply was developing in London, and there was no profit at all. He considered it would be quite hopeless to raise the money with such prospects, and that the principle was all wrong, as there must be some hope of a return on capital. Such a scheme would not lead to any practical result. He considered that the existing supply over large areas of the country was very good; there were few towns where industry could not be satisfied electrically, and he thought it was unnecessary to belittle our present position. Probably in no part of the world were better results obtained than in the North-East Coast area. He thought if any one industry had suffered from legislation, it was the electrical industry, and pointed out that all the largest industries in the country had been developed by private enterprise, and that when Parliament stepped in trouble resulted. They did not want too much legislation. He believed that if the same opportunities had been given as in the case of the railways, the electrical industry would be in a much better position now. Mr. Williams suggested a board of control, which reminded him of the Water Board, but who were the board to be responsible to? He thought if they removed the commercial element from the proposed board, making it a technical board, he could agree with it.

Mr. H. Faraday Proctor said he differed from both Mr. Williams and Mr. Merz, believing that technical considerations should be dismissed, and the proposed board formed to get on with the work; if left to the Institution, the scheme would be stifled by the conflicting interests. The proposed scheme did not interfere with the existing concerns; he was afraid that Mr. Chattock's idea of scrapping existing plants would tend to delay matters indefinitely. He agreed that such a scheme would do more to cheapen supply than any independent effort. The proposal to use canal routes for transmission lines should be extended to railways, and one controlling body should supervise matters; until some such procedure was adopted we could not hope to get prices down to the desired level.

Mr. W. B. Woodhouse said it was important that electrical engineers should first agree what to do. Mr. Williams had put forward a scheme for electricity supply, but that was only a link in the fuel problem, for fuel economy depended on the realisation of electricity supply on a gigantic scale. On the broad principle of centralisation of supply, he hoped they were all agreed; they might differ as regards organisation, but if they agreed on the broad principle they had gone a long way. They must give security for capital, but the large schemes would necessarily be to some extent speculative. On the other hand, if the Government would advance the capital, it would be beneficial. He was afraid he could not agree as to the basis of organisation. To achieve success, the public must be educated to an appreciation of the dogma to be followed; they must tell the public about it, and keep on telling them before any progress would be achieved.

Mr. C. H. Wordingham said he had looked at the subject of electricity supply from all points of view; now he looked at it from a detached point of view, and, as a result of his experience, was quite convinced that a number of the power companies were in business from "purely philanthropic motives." He had been interested in Mr. Merz's remarks, but his suggestions that night represented something very different from the original ideas of promoters of power schemes, who asked for a single large power station. The real secret of economy was to get diversity. The linking-up proposal of Mr. Merz was admirable, but where was it to stop? The most successful power supply scheme had a large number of linked-up power stations. Turning to Mr. Williams's proposals, he deprecated any form of Government interference; the scheme must be run on commercial lines and show a financial return. No Government department could successfully conduct a commercial undertaking, and under Government control all the time would be occupied in receiving inspectors and making returns.

Mr. Madgen took exception to the description of the Ontario Hydro-Electric Commission's work; of all the bodies he had met with, none carried out its work in a more reprehensible manner. The Commission not only regulated the supply industry as a whole, but it also competed with other independent undertakings, resulting in the crushing out of enterprise. The consulting engineer branch was gradually disappearing! He thought in regard to the proposed board, that if it was divested of the business of operation it might do well.

Mr. Thos. Roles considered that the electrical profession was agreed on the right scheme of electricity supply, and that engineers would support the proposal put forward, especially if they happened to be on the suggested electricity board. The success of the proposal really depended on the human factor, and it was asking a good deal of the engineers of smaller undertakings if they were to efface themselves for the benefit of the country as a whole. The fate of the engineers of those undertakings which had been absorbed in the past was known. If all the engineers could be brought into the scheme, they would get a body of opinion in its favour; if they could safeguard the engineers, it would not be long before the engineers would convince their committees. But the talking should cease, and he thought the Institution was the right body to take action, as it would combine the wide-spread interests.

The President (Mr. C. P. Sparks) agreed that the stumbling block was the human factor, and cited the cases where engineers had rejected the idea of bulk supply to their undertakings. The real principle at the bottom was the conservation of fuel, which was more important than cheap power. He was sure that the Council would consider the views expressed during the evening.

THE BUSINESS SIDE OF SCIENCE.

At a meeting of the North-East Coast Institution of Engineers and Shipbuilders, on April 7th, Mr. T. C. Elder (of the British Electrical and Allied Manufacturers' Association) delivered an address on the part that would be played by science in the coming economic crisis. Referring to the conference recently summoned by the Royal Society, at which it was decided to form a joint board of scientific societies, to promote the application of science to industry, he remarked that in the past the relationship between these two parties had seemed to be based on a sort of mutual contempt; but the times had changed, old methods must be abandoned, and the business of industrial production and distribution must in future be carried on with greater efficiency—*i.e.*, on more scientific lines. As a result of the war, the capacity of British engineering works had been immensely increased; at the end of the war they must find outlets for their products, and this could only be done by the cultivation of the scientific habit and method in the economic system of the country. The accounts of manufacturing concerns were annually subjected to a minute investigation by professional experts, so that the true financial position should be disclosed; surely, if this had been found a salutary process, it ought to be extended to other departments. Competent men for such work, who could overhaul the purchasing department, revise the technical designs, appraise the efficiency of the machinery, or devise improved methods of promoting sales, were scarce and expensive, but he would suggest a practical solution of this difficulty. The principle of association was gaining ground, but there was a danger of associations becoming mere hindrances to progress: the kind of association that was wanted was one that would act as a persistent stimulus, not as a technical debating society. He looked to the manufacturers' associations for a method of pooling the experiences of members and providing the equivalent of a system of auditing for various departments. The great fault of most manufacturers

who entered such associations was that they did not make full use of the powers so developed, but struggled to retain their own freedom. Such associations could generalise from a wider range of particulars than came within the purview of a single firm, and could help their members in respect of the purchase of materials, conditions of labour, the establishment of co-operative sales agencies in foreign markets, and so on. They should themselves be assisted in their attitude towards public policy by a board representative of the scientific and technical institutions, especially as regarded our unscientific and unbusinesslike system of education and our inefficient executive government. These associations should combine in a campaign of popular enlightenment, to demonstrate the importance of British engineering to civilisation, its immense earning power, and its social and economic possibilities. In brief, Mr. Elder urged that scientific institutions should jointly prepare plans for the reform of our educational system, combine with commercial associations to increase industrial efficiency (and, therefore, national prosperity) all round, enlighten public opinion on questions of industrial economy, showing the workers that it was to their interest to extend, rather than to limit, production, and find effective means of expression in Parliament. The public, having been protected by engineering from a ruthless enemy, should now protect engineering, and they should mix business not with revenge, but with patriotism, politics and science, so that those industries in particular which were indispensable to peace and prosperity should be given full freedom of development for the security and progress of the Empire.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

I am one of many who feel that the I.E.E. yields a totally inadequate return for the annual subscription to the vast majority of its members. All they receive is a copy of papers submitted by their fellow members and the discussion thereon, which they can equally well obtain by subscribing to your paper.

The Institution should be representative of the industry throughout the Empire, and its work and standing such that this position is generally recognised. In Canada the position it should hold is held by the American I.E.E.; in South Africa it has no standing whatever; there is supposed to be a Local Section in Cape Town, but in practice this does not exist, whilst in Johannesburg (the centre of a large and active electrical community) an excellent independent Institution has been established. I cannot speak of the state of affairs in other Colonies, but I fear it is no better than in those I mention.

In discussing the situation in Johannesburg with a member of their committee, he said: "We had to give up all pretence of being a Local Section of the home concern, as they demand 75 per cent. (or thereabouts) of our income, for which we get little or nothing, and the balance was totally inadequate to carry on efficiently here," and this is true elsewhere.

It seems to me that the Institution, to serve its purpose, must:—

1. Be so strong that its influence carries real weight with the Government and other public bodies.
2. Take a lead in electrical research work throughout the Empire.
3. Take a lead in technical education throughout the Empire.
4. Take active steps to develop our electrical trade abroad and to increase our prestige generally. To these ends it should use its influence to place its members where possible, in the many responsible positions available abroad.
5. Have such a number of sub-committees as will reasonably represent the interests of the various branches of the industry (these committees need not necessarily meet in London; Manchester would, perhaps, be a convenient centre for the manufacturers' section; Sheffield for central-station engineers; Birmingham for education, &c.).

To develop properly these suggestions I think, in addition to its present staff, the Institution should employ at least one active, highly-trained, practical engineer of recognised standing. Then, the social side needs developing; the opportunity of meeting other engineers, including those outside the scope of our Institution, is very valuable. This, I think, may best be achieved by the formation of Engineers' Clubs, on the lines of that in existence in Manchester, say, in London, Newcastle, Glasgow, &c., with interchange of membership. These clubs, of course, should be self-supporting when once started.

All these objects need money, and the Institution has it, but, unfortunately, it is sunk in that great "white elephant" on the Embankment (incidentally, an eminent central-station engineer tells me that he has calculated the load factor of that place so far as our members are concerned to be between .040 and .045 per cent., but I am sure it is not nearly so high in the case of most members). This building should be sold, or other steps taken to reduce our rent charges in London to, say, £1,000 or £1,200. This would leave a considerable annual sum free for the above objects, including the treatment of members attached to Local Sections on equitable lines with the fortunate residents around London, who not only have the daily privilege of viewing the "white elephant," but are provided with a free annual conversazione, institution-aided dinner, &c., all of which the great majority of members are denied.

I have discussed these matters with many of our members, and with members of the "Mechanicals," many of whom hold similar views regarding their Institution, and it seems to me that much is to be gained by both parties (and, possibly, other engineering societies) by a close co-operation without in any way disturbing the integrity of each. Thus, by such co-operation, the question of housing accommodation in London and for the Local Sections could be put on a satisfactory basis, and also the development of the club idea suggested above; but, more important than all, a really "heavyweight" joint committee representing the allied branches of engineering could be formed.

Care should be taken in future that, as far as possible, the Council of our Institution contains a fair representation of the various branches of the industry. At present there is a strong tendency for members holding public or semi-public positions to predominate. I do not think one of our large general manufacturers is represented just now, unless through a Local Section, although, both in the matter of providing "papers" and adding to the discussions, they are a most active class.

In support of my opening statement, may I point out that, although we have been at war some 20 months, and the industry has badly needed a lead, all the Institution has apparently done during that time (apart from the reading of papers and adding to the discussions, they are a most active class.

M. I. E. E.

Decimal Coinage and the Metric System.

The enclosed printed copy of the report of the Decimal Association and your own strong and valuable lead in this matter must be my excuse for appealing to you for further attention. The Association propose the division of the shilling into 50 parts (cents). Surely this is wrong.

1. It is unjust to the great mass of the people. Why should the limit of justice remain at 2 per cent. when it is simple and easy to set the scales to 1 per cent.? Whether we like it or not, the shilling is the standard coin, and will remain so. The shilling should, therefore, be divided into 100 parts (cents), and so make an adjustment of prices possible within 1 per cent.

2. We are trying to introduce a sound decimal system; can the system be called sound which will make ten shillings consist of 500 cents?

3. We are trying to get into step with the other nations, who have long ago adopted the decimal system; can it be called getting into step if we take one to their two? Will any amount of persuasion make the French, the Belgian, the Italian, the Scandinavian, and other nations think of our shilling as 50 cents when their own corresponding and standard coin consists of 100 cents?

The two great stumbling blocks seem to be: (1) The desire to keep a coin as near as possible to our farthing as the comfort for the poor, and (2) the wish to divide the pound sterling into 1,000 as comfort for the richer. Undoubtedly the change to the decimal system can be made at the present moment much more easily than before the war, but let us keep in step with our Allies, even if our enemies are marching to the same tune.

C. Thorkelin.

[Provided that the system is decimal, we see no great advantage in making the shilling the standard unit. The only current coin of the same value is the German mark! The Russian rouble is equivalent to 2s. 1¼d., the Chinese tael to 2s. 5d., the Argentine peso to 1s. 9d., the Brazilian milreis to 1s 4d., the Canadian and American dollar to 4s. 2d., the Dutch gulden to 1s. 8d., the Indian rupee to 1s. 4d., the Japanese yen to 2s., the Mexican dollar to 2s., the Peruvian sol to 2s., the franc and allied coins to 9¼d.—where is the uniformity attributed to the shilling?—EDS. ELEC. REV.]

WAR ITEMS.

After the War in France.—The Conseil-General of the Department of the Seine has adopted (says a correspondent of the "Daily Telegraph") the conclusions presented in the report of MM. Sellier and Deslandres on the economic measures to be taken for the organisation of labour on the demobilisation of the armies after the close of hostilities. The programme of public works outlined comprises most important plans for railway extension, and an enlargement on a great scale of the canal system, as well as the general improvement of the seaports.

Exemption Applications.—At the Stockport and East Cheshire Appeal Tribunal, a young man employed on the clerical staff of the Manchester Corporation Tramways Department stated that he had a conscientious objection to combatant or non-combatant service under the military authorities. He had resigned his position in the Manchester Tramways Department because he could not implicate himself by handling correspondence in relation to munitions. The decisions of the Tribunal were not made known publicly.

The Preston County Appeal Tribunal last Thursday heard an appeal by an electrical engineer, aged 26, who urged that his ability in his profession would be of more service to the country in a civil capacity than in the service of the Army. The appeal was dismissed, and the military representative was asked to recommend the man for service with the Royal Engineers.

At Douglas (Isle of Man), the tribunal has granted absolute exemption to Mr. Thomas Sheard, electrician in charge of the Government electrical plant at the Athol works.

At Poole, the Bournemouth Electricity Co. appealed for 12 employés. Mr. E. L. Ingram, for the company, said it was prepared to release two of the men who were in certified occupations, and withdraw two other claims. The appeals were for a stoker, two charge engineers, one works manager, two switchmen, and two motor-wagon drivers. Before the war the company had between 135 and 155 men, and at present the staff consisted of 85 men and boys, and they had over 75 men with the Colours, and were paying over £700 a year in separation allowances. The tribunal granted exemption to six men as being in certified occupations, and refused the appeals as to the motor-wagon drivers.

At Stroud (Glos.), Messrs. Edwards and Armstrong, Ltd., electrical engineers, appealed for 32 employés, who had attested, on the ground that they were in a reserved occupation. It was stated that time was needed to replace some of the charge men who were going to join up. Since the outbreak of war 30 men had left to join the army. It was arranged that nine men should be exempted for 14 days, and the remainder conditionally exempted until September 29th.

The Lowestoft Town Council has secured exemption for the remaining employés at the electricity works.

Dartford Rural Tribunal has granted two weeks' exemption to Mr. A. Brakefield, electrician to Mr. A. J. Hewings, of Northumberland Heath.

At the Newcastle-on-Tyne military tribunal, on Monday, an army captain, who has a business as an electrical engineer, applied for the exemption of his brother, in order to carry on the concern. All but two of his men had enlisted, while his other brother was in the Navy. They were both married men, and they had a mother to support. Conditional exemption was granted.

Conditional exemption has been granted to Mr. Charles F. Clayton, who is in charge of electrical plant at Stone (Kent).

At Salford a firm of electrical engineers appealed for a man engaged in armature coil winding, and stated that all the work was for public use or for places engaged on munitions. Fifty per cent. of their employés left early in the war, and women had been engaged to do light work. Exemption was granted conditional on the man remaining at his present occupation.

Before the Cheshire Appeal Court, the Military appealed against three months' exemption allowed the managerial secretary of the Weaverham Electric Supply Co., on the ground that he was not devoting the whole of his time to the work. Respondent said that the whole burden of the concern, except the engineering, fell upon him, and his duties required a great deal of technical knowledge. The appeal failed.

The Worksop tribunal has granted temporary exemption to the Station Superintendent at the Urban District Council electricity works, and also to two stokers, a cable jointer, and a fitter, all of whom are married, and until September 1st to the meter tester, who is single.

At Maidenhead Tribunal, the appeal of Mr. R. C. Walker, who had been refused exemption, was withdrawn by Mr. G. F. Craven, manager of the Reading Corporation tramways, Mr. Walker being medically unfit.

At Yarmouth, an electrician of two picture palaces was granted two months' exemption.

At St. Albans, Mr. A. Flower, electrical and motor engineer, appealed on the ground that he was in sole control of machinery engaged on Government work. The case was adjourned for 14 days.

At Brighton Tribunal, an electrician who had previously been granted 14 days' postponement for one of his men, appealed, stating that the man was the only one capable of undertaking any repairs that might come in. Two months' extension was granted.

German Dumping.—A political correspondent of the "Daily Telegraph" says that the statements with reference to great preparations for a dumping of accumulations of German manufacturers may be accepted too readily. They do not square with information in the possession of our Foreign Office and the Board of Trade. Any extensive German preparations would certainly have been heard of through neutral channels. The known state of German industries leads the Government to discount the statements.

German Dumping After the War.—The Exchange Telegraph Company's special correspondent at Stockholm describes the great dumping plan under which Germany, by exporting vast quantities of cheap goods now ready, is to pay for raw materials and to regain at a bound her lost markets. Manufacturers' associations of a new kind are being formed, which will aim at common action and prevent excessive production of some products, or insufficient production of others. They will also rule certain technical questions and questions of saleability arising out of the changing public taste. Makers of optical and surgical instruments, electrical machinery and machine tools are all working together. The amount of dump goods which is considered necessary is distributed for production among different factories on lines which ensure economy and division of labour. The production price has been cut so low that the 90 per cent. of sale value, advanced by the State to enable production to be carried on, has been reduced. In the campaign for economy factories and workshops are being standardised and specialised. Where two shops in a given area formerly produced indiscriminately two classes of goods, one factory has now taken over altogether one class and the other factory the other class. Sometimes machinery has been exchanged. There is no doubt that neutral States and, if they allow it, enemy States, will be badly hit by German competition, especially if, as Germans themselves predict, a period of industrial depression follows the war.—"The Times."

Nitrogen for Munitions.—A lengthy question was addressed to the Minister of Munitions by Mr. T. M. Healy in the House of Commons, last week, with regard to the relations between his department and the Nitrogen Products and Carbide Company, which uses the Otswald process of manufacturing nitrate of ammonia and nitric acid. It was suggested that the process, which was purchased at the price of £652,108, had been superseded by the Harber process of the Bädische Anilin-Fabrik, that money provided by the Government had been used to erect works in this country for the treatment of nitrolim, and that the process had exceedingly injurious effects upon the health of the workmen employed; also that in the flotation of the company large blocks of shares were given free to certain persons and firms. In reply, Mr. Lloyd George stated that a contract had been placed with the company on favourable terms, under which the Government advanced, not £400,000, as alleged, but £50,000 at 5 per cent. interest, repayable by deductions from the price of the goods supplied; enemy shareholders held only about 2 per cent. of the capital, and the process had not been superseded by the Harber process, by which ammonia was manufactured, and not nitric acid or nitrate of ammonia. There were no deleterious effects upon the workmen employed, not a single case of disease having occurred through its use, although very large quantities of the material had been produced, and the persons named received no free shares, their holdings having been paid for in cash and by the surrender of equivalent shares in other companies.

Trading with the Enemy.—The Board of Trade directs the particular attention of all manufacturers and traders concerned to the need for scrupulous care in the transaction of their business abroad, in view of the fact that some traders in some neutral countries are making themselves agents for the supply of goods to and from enemy countries. Especial care should be taken in opening new accounts in neutral countries, and in relation to any orders or inquiries of an abnormal character. In any case of doubt as to particular firms abroad, business should be suspended pending reference as regards firms in foreign countries outside Europe to the Controller, Foreign Trade Department, Lancaster House, St. James's, London, S.W.; and as regards firms in Europe to the Chairman, War Trade Intelligence Department, Broadway House, Tothill Street, Westminster, London, S.W.—"The Times."

After-the-War Trade Policy.—In the House of Commons last week, in reply to a question whether Ministers were taking steps to formulate a trade policy to come into operation after the war, Mr. Asquith stated that a Committee of the Cabinet was appointed some time ago to deal generally with all questions of reconstruction, including those connected with commercial and industrial problems likely to arise at the close of the war. Investigations of particular aspects of the problem were being carried on by sub-committees. As to the most important, the Government were in communication with the Dominions.

Trade with Russia.—The Vice-Chairman of the Sales Managers' Association, Mr. William H. Beable, is leaving for Russia as the representative of various important British business firms to open up new trade with our Ally. He is going with the cognisance and approval of the Government, and his Majesty's diplomatic and Consular officers have been given instructions to offer him every assistance they can. His stay will be of not less than six or eight months.

Prohibited Trading.—The "London Gazette" for April 14th contains a schedule of additions to the list of persons and firms with whom trading is prohibited, in Argentina

and Uruguay, Brazil, Cuba, Ecuador, Netherlands, Netherland East Indies, Persia, Peru, Portugal, and Sweden.

No Ministry of Commerce.—In reply to a question in the House of Commons, as to whether the Prime Minister would take early steps for rearranging the business at present dealt with by the Home Secretary, the President of the Board of Trade, and the President of the Local Government Board, with a view to creating, while the war is in progress, an adequate Ministry of Trade and Commerce, Mr. Asquith said that he was not prepared to adopt this suggestion.

Companies to be Wound Up.—The Board of Trade has ordered the following companies to be wound up:—Rhineland Manufacturing Co., Ltd., Wells Street, Oxford Street, London, W., importers of ball bearings for machinery, &c.; controller, L. F. Goodricke, 10, Coleman Street, E.C. Nitsche and Gunther Optical Co., Ltd., Hatton Garden, E.C., manufacturers of optical instruments, &c.; controller, B. E. Mayhew, Alderman's House, E.C.

Naturalised Aliens.—The Baltic Mercantile and Shipping Exchange, which has excluded from its premises not only all allen enemies, but also naturalised persons of enemy origin, except those over 60 years of age or having sons serving with the Colours, has further decided to ascertain by circular from the members whether the majority wish to exclude all persons of German origin.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Church Lighting with Concealed Sources.

The artificial illumination of a church is a problem which stands by itself, and calls for the soundest judgment and a cultivated sense of the artistic and appropriate qualities which are too often conspicuous by their absence from the scheme adopted. Indirect, or semi-indirect, lighting is seldom practicable, owing to the height of the roof and its dark surface, hence direct lighting must be adopted; but it does not follow that the lamps or their fittings should be visible. That satisfactory lighting can be secured with concealed light sources is proved by the scheme that has been adopted at St. Dunstan's Church, East Acton. This installation is of special interest, not only because the system employed is novel and most effective, but on account of the low cost for which it has been carried out.

When it was decided to replace gas by electricity for lighting the church, the funds available were somewhat limited, and allowed of but a small margin for the purchase of fittings after the wiring costs had been met. The contractors for the work, Messrs. Duncan Watson & Co., 62, Berners Street, Oxford Street, after

Fig. 1.—Example of Concealed Church Lighting.

consultation with the illuminating engineering department of the British Thomson-Houston Co., Ltd., hit upon the happy idea of dispensing entirely with fittings as usually understood, and of lighting the church by trough reflectors concealed between the mouldings of the arches at the points where the latter spring from the pillar capitals.

Three Mirolux extensive type trough reflectors, each equipped with two 60-watt standard Mazda lamps, are provided on the east side of the pillars on both sides of the nave. Persons passing up the church, therefore, can see neither the fittings nor the light sources, the illumination being thrown forward and distributed with remarkable evenness throughout the building. The lamps and fittings can be seen, of course, when passing down the building from the east end. The value of the illumination on the working plane, *e.g.*, on the top of the pews, averages between 2·5 and 3-ft. candles, which is well above the figure usually allowed for church lighting. This permits of the congregation following the service in comfort, even with books having the smallest type, a condition that prevails in very few churches, the light distribution usually being very uneven.

For the lighting of the chancel, a pair of similar reflectors, each with two 60-watt lamps, is placed on the east side, just above the lower capitals of the pillars supporting the main arch while light is thrown upon the altar by single trough reflectors placed within the reveals of the two side windows.

A telescopic standard carrying a conical reflector which conceals a standard lamp is placed behind the vicar's stall, and this also illuminates the book on the lectern alongside. The music on the organ is lighted by a tubular lamp, with an adjustable reflector. The circuits are so controlled that almost any variation in the light can be secured at will.

The installation was designed and carried out under the supervision of Mr. A. A. Blython, of Messrs. Duncan Watson & Co., the wiring being enclosed in heavy-gauge screwed barrel throughout. Although it has been run on the surface, especial care was taken to make the runs as inconspicuous as possible, and at a casual glance no evidence of the conduit is visible. Current is supplied from the D.C. mains of the Metropolitan Electric Supply Co., at 230 volts. The accompanying illustration has been reproduced from an untouched photograph taken by the unaided light of the fittings installed, and shows that no fittings are visible.

Electric Foot Warmer for Policemen.

Policemen on point duty, regulating traffic, &c., in cold weather are likely to suffer from cold feet in the literal sense. To cope with this trouble, the City Council of Pittsburgh, U.S.A., has adopted a device worked out in conjunction with Mr. Drew Johnston, of the Duquesne Light Co. It consists of a warming plate, 18·5 in. square and 1·5 in. thick, connected with an electric plug and switch on a pole at the curb. The intermediate connection is a flexible armoured conduit about 10 ft. long. The policeman, when he leaves his post or when the weather is not severe, carries his heater to the curb and pulls the plug from the socket. Mr. Johnston took the matter up with the experimental department of the Westinghouse Electric and Manufacturing Co., and the heaters were made by it. The switch controlling the heater permits of four temperatures, which can be changed to meet the rigors of the weather. At no time does the foot plate develop a temperature that will burn the soles of the shoes; the idea is not so much to warm cold feet as to keep the feet from getting cold. For all ordinary weather conditions the heater can be operated on less current than is required for two ordinary 40-watt lamps, such as are used in residence illumination.—*Elec. Review and W. Electrician.*

The Insulation of Joints in High-Tension Cables.

The extremely unfavourable conditions, such as limited space, damp atmosphere, &c., under which most high-tension cable joints have to be made have emphasised for a long time the desirability of improvements in joining methods and materials. Such improvements should, as far as possible, accomplish the following objects: (1) Minimise the time of exposure of the open ends of the cable; (2) facilitate the mechanical joining of the conductors by solder-

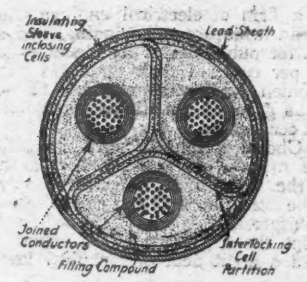


Fig. 2.—Cross-Section of Completed Joint.

ing all three at the same time, thus avoiding the necessity of bending the conductor ends away from their usual position; (3) eliminate the necessity of replacing insulation over the exposed section of the conductors by hand-wrapping; (4) provide insula-

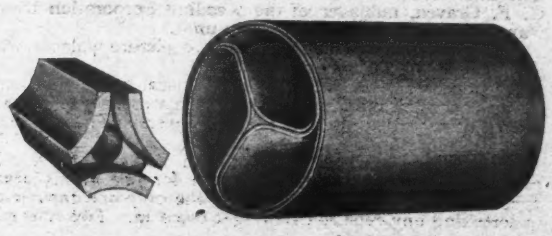


Fig. 3.—Assembled Cell Partitions, Enclosing Sleeve, and One of the Conductor-Spacing Blocks

tion in such form as entirely to eliminate the variations and uncertainties due to workmanship, and so design the insulation of the joint that it is reduced to a simple mechanical assembly of

parts that when assembled must necessarily be in the proper position and uninjured.

To meet these conditions and produce a joint insulation which will equal that of the cable, the materials and joining method described below have been developed. The insulation, known as "Conduscll," comprises a seamless outer sleeve of a material (micanite) of high dielectric strength, and three identical inner sections of such shape that they may be assembled singly after the three conductors are metallically joined. When the three parts are assembled there is an unusually long leakage path between conductors. Furthermore, the spacing around each individual conductor is elliptical, so that ample room is provided for the filling compound to flow freely into all spaces and leave no voids. The three inner sections when assembled interlock and present a uniform circular contour on their outer surface over which the seamless sleeve may be drawn. These insulating barriers are held in positive relation to the conductors by means of porcelain blocks like the one shown in fig. 3. The blocks ensure equal separation and amount of insulation between the conductors, as well as between them and the lead sheath. The length of exposed individual conductor is relatively short, resulting in materially reduced over-all dimensions of the joint.

The three inner sections, owing to their shape, may be placed between their respective conductors and brought into final position very readily. The operation requires only a few minutes, and no assistance from the splicer's helper. Besides reducing the cost of labour, this method of assembly minimises the length of exposure of the cut ends of the insulation to the atmosphere.

Tests on various sizes of commercial joints of this type have shown that they will withstand 200 per cent. normal pressure indefinitely and that the ultimate breakdown pressure is higher than that of the cable itself. A special compound has been developed for use with this type of joint.—*Electrical World.*

LEGAL.

Electric Switch Manufacturers and their Premises.

In the Shoreditch County Court, on Tuesday last week, before his Honour Judge Graham, K.C., Mary Ann Rowlandson, sued Messrs. Marbro, Ltd., of Hackney, electric switch manufacturers, to recover £12 10s., being two months' rent of the premises they occupied, and an order for possession. It appeared that the present company purchased the business of another firm, who had entered into an agreement as to the premises as far back as 1909. The present company contended that theirs was a yearly tenancy, so long as they paid the rent, and that they were actually in negotiation for another lease for three years when they got the notice to quit.

For the defence, Mr. Poyser said the notice to quit was dated March 10th, and the plaintiff had actually taken rent to April 10th, which quashed the notice to quit. Mr. Rowlandson admitted receiving a cheque, and also paying it into the bank, but pending seeing his solicitor he had not sent any receipt.

Judge Cluer said the paying in of the cheque was fatal to the plaintiff's case, as legally it was the acceptance of rent. There would have to be a verdict for the defendants, with costs. No doubt more would be heard of the case later.

Munitions Cases.

An interesting decision was given last week by the Oldham Munitions Tribunal, in a case in which a fitter employed by Messrs. Ferranti, Ltd., asked for a leaving certificate, so that he could take up a foreman's position in a new National shell factory. The case for the man was based on the fact that it was for the National advantage that his skill and personal qualifications should have wider scope than he had in his present employment, and Sub-Sec. 5 of Sec. 5 of the Munitions of War Act, 1916, was quoted. This Sub-Sec. states that in determining whether the grant of a certificate had been unreasonably refused the Tribunal should take into consideration the question whether the workman had left or desired to leave his work for the purpose of undertaking any class of work in which his skill or other personal qualifications could be employed with greater advantage to the National interests. Mr. Asa Schofield (A.S.E.), who appeared for the man, said he could get another man to replace him in his present job. His present wages were 46s. for a week of 53½ hours, and there was overtime, and at the new shell factory he would receive £3 10s. for a week of 54 hours, and overtime at a corresponding rate. On behalf of Messrs. Ferranti's, Mr. Whittaker said they would be glad to have twice as many men in the tool room as they had now. It was imperative that this man should remain, and they were prepared to take every tool maker the Labour Exchange could supply. Mr. Schofield said he was satisfied that the skill of the man would be better utilised in the new job and he would replace him with an efficient tool maker. The Tribunal decided to grant the leaving certificate asked for, and Mr. Whittaker said he would appeal to the Ministry of Munitions against the decision. Mr. J. F. Hodgson (chairman) said the case was of importance to both sides, and he would afford every possible facility for appealing.

A girl employed as an armature winder applied to the Manchester Munitions Tribunal, last week, for a leaving certificate, on the ground that her health was endangered by her employment. No doctor's certificate was produced, and the firm stated that the girl's work was very important. The Tribunal refused the application.

Lighting Regulations.

At the Police Court of a town in the North-Eastern counties on 13th inst., the assistant engineer-in-charge of an electric power station was charged with not obeying the instructions of the authorities to extinguish all lights. For the prosecution, it was stated that on a recent night, Zeppelins visited the county and dropped bombs. The police conveyed an official warning to the defendant, and the lights at the station were extinguished with the exception of those in the boiler house. These were allowed to remain lit from 10.38, when the order was given, until shortly after 11. Four bombs were dropped in a certain district, and at that time lights in the boiler house were on, but immediately after the report of these bombs, the lights were put out for the first time. Very shortly afterwards, two more bombs were dropped. The lights complained of were in a shed 150 ft. long, with a glass panel 6 ft. wide running along the roof, whilst in the side of the building there were six or eight windows 4 ft. square. The glass had all been whitewashed, but that was not sufficiently effective. The light could be seen for a distance of 400 yards on that particular night.—For the defence, it was stated that the lights were small and were left on to illuminate the water gauges. There were also four lights beneath the coal bunkers, and it might be that some degree of light escaped from these, though all the glass had been obscured with black paint. Defendant turned off the lighting current to the outside world, but unfortunately omitted to turn off the lights in the boiler house. When defendant heard the report of a bomb which was dropped four or five miles away, he woke up to his duties, pulled the switch and turned off the lights in the boiler house. It was a serious offence, and the defendant regretted it, but there was no wilful or felonious intent. The Chairman of the Bench, in announcing a fine of £10, together with £2 2s. solicitor's fee and £1 for witnesses, or 43 days' imprisonment in default, observed that at such a time a man in defendant's position should have been exceedingly careful, as it might have proved a serious thing both for himself and the people in the neighbourhood. However, the fact of defendant having lost his situation had prompted the magistrates to take a rather lenient view of the case.

Dispute About Springs.

In the City of London Court, on April 13th, before his Honour Judge Atherley-Jones, K.C., an action was brought by the Lion Spring Co., Ltd., Oldbury, near Birmingham, against the Carleon Electrical Co., Ltd., 13, Queen Street, E.C., to recover £39 for 25,000 percussion springs and 25,000 detent springs, supplied to their specification, at 1s. 6d. per gross, for the Government. It seemed that the defendants had a contract to supply the springs to the Government in May of last year. The work was carried out, and cash was to be sent on delivery. Defendants refused to pay on the ground that the springs were not made in accordance with the specification, as they were too weak, and some of them were returned. Plaintiffs said that the Government Inspector agreed to pay for the springs because they were made before the specification drawing was altered. The defence was that the springs had not been accepted by the Government, and therefore plaintiffs could not expect to be paid. The Government official, when called, admitted that his inspection was not final.

Judge Atherley-Jones said that that being so, the plaintiffs could not recover, and must be non-suited, with costs.

Judgment Summons.

In the Shoreditch County Court, on Tuesday last week, before his Honour Judge Graham, K.C., Messrs. R. Becker & Co., of 53, City Road, N.E., talking-machine electric motor manufacturers, sought to enforce the payment of a judgment debt of 12s. 9d., out of £5 12s. 9d., for goods supplied, from Wm. Saunders, of Cedric Works, Forest Gate. The defendant said the machinery at his place was not worth £100, but it might be worth £40 to £50; but all the same his business was in such a state that he was unable to pay 5s. a month. He used to have 22 men, but now had only four, as the rest had gone to the war; he was doing his best to keep his business going.

Judge Cluer: And you mean to say you cannot pay 5s. a month?

Defendant: No, your Honour.

Judge Cluer: Committed for five days, suspended for 10 days.

Krupp's Patents for Magnetic Separators.

On Thursday last, in the Patents Court, applications for licences to manufacture under these patents on the part of Messrs. Edgar Allen & Co., Ltd., were heard by the Controller of Patents. The previous hearing of the application of the Rapid Magnetting Machine Co., Ltd., was reported in our issue of April 14th. Sir G. Croydon Marks stated that Messrs. Edgar Allen & Co., Ltd., had an order from the Government for three Ullrich magnetic separators, which were urgently needed. They proposed to pay a royalty of 5 per cent. on the net selling price.

The Controller inquired as to the relationship between Messrs. Krupp and the patentee Ullrich, and it was stated that the patents were not the property of Krupp's.

The Controller granted both applications, the royalties to go to the Public Trustee; he said that the presence of an English machine already on the market took away any exceptional character which might be claimed to attach to Krupp's.

IDEAS AND ACTION.

Though the Government restrictions on paper consumption form a very considerable handicap to journals whose object it is to encourage national trade and industry, they have not stopped the production of pamphlets and other literature concerning the trade and cognate problems arising out of the war. A number of these lie before us at this moment calling for attention. One writer,* in language giving no uncertain sound, argues against letting the Germans off easily, and states that a perfectly cold-blooded consideration of right and policy points to a relentless but impassioned treatment of a ruthless and unscrupulous enemy. The revulsion that is engendered by the horrors of war should, in his estimation, be the basis upon which our present and future attitude toward the German nation and the German individual should stand. The ineradicable dishonesty of the Germans in political and in economic affairs, their underhand intrigues, their organised hypocrisy, and their unscrupulous abuse of international hospitality, their use of their embassies and consulates as hotbeds of intrigue, are all summarised, once more leading up to the conviction that we must never again live with murderous thieves at large in our house. The bestialities and outrages on land and on sea, together with a review of the degeneracy of the people as revealed in German criminal statistics of peaceful life in their own land, are also produced by this writer to stamp the German people as "now and for ever beyond the pale," and our only way is to permanently deprive such a people of all power to impose their will by violence or intrigue. Until a new generation of Germans one day arises "we need not hate, but we must refuse to associate or to allow our people to associate with a nation rotten with a moral leprosy." Here the record ends—the sentiments are natural, we all hold them, we have expressed very much the same views ourselves a score of times, but the writer would have added to the value of his contribution if he had told us how all this was to be done, and how our international transactions as a whole would be affected if we were to decline to have relations with all the peoples of the earth whose standards of morality at home were different from our own. Moral depravity of a race has not generally been a bar to commercial transactions—we never should have made those early pioneering foreign trade relations to which we owe so much if we had first asked "for a certificate of marriage." Yet it is the Allies' duty to see that it is impossible for Teutonic commercial success to prepare the way for military measures in the future.

From this epistle of the hard-hitting quarantining apostle, whose sentiments we repeat, multitudes of men of British birth must share in these awful times, we turn to a second pamphlet in which Mr. A. W. Yeo, M.P., sends us his views on "Trade After the War." We agree with his prefatory note that a satisfactory commercial outcome of the war is only second in importance to our being victorious over our enemies in the field and on the sea. Mr. Yeo pictures the state of things when "immediately" the war is over five million citizen soldiers and workers on Army contracts will be clamouring for work. Nearly every one of our industries has been disorganised, and he dreads the interval between the cessation of war and the getting into our regular commercial stride, and he proceeds to give the advice already so frequently tendered, "Be Prepared!" He goes on to show how largely in our Home and Colonial domestic and industrial purchases, from toys to machinery, we have depended upon Germany, and holds out before us the prospect of benefiting British industry by keeping this trade to ourselves. Free Traders, he says, must be prepared for a modification of our policy, but he adds that together with such modification we must of necessity devise precautions against the avarice of manufacturers—"the State must absolutely prevent the manufacturers from becoming unduly rich at the expense of the retailers and consumers." We find what is working in Mr. Yeo's mind in the "object lesson in paper"—the case certainly powerfully appeals to our journalistic sympathies. The Government restricted the import of pulp; there were vast stocks of paper in the country which had already borne the full cost of production; yet the State did not prevent the holders of these finished stocks from raising their prices from 100 to 300 per cent. "absolutely without justification," and thus "the State made to these paper merchants a gift variously estimated at from three to five million pounds," and the journals which foster the trade of the country, among others, must stand the racket. This illustration Mr. Yeo uses as an argument against the State interfering with the laws of supply and demand, and to show that if such interference is necessary, "such scandals" must be prevented. He would rather see us leaving the manufacture of cheap toys to Germany, and employing our present reducing volume of labour on more useful and profitable lines—machinery, gas and electrical fittings and motors are among those lines. Mr. Yeo says that owing to the increase in the employment of female labour, which "has come to stay," we shall, when the war is over, have increased our productive workers by two million persons, who within three years would increase the value of our output of goods by £300,000,000. But to do this we "shall require machinery and plant costing some £40,000,000, and there's the rub!" A scheme has been put before the Board of Trade which finds a way for getting that money.

We do not think that Mr. Yeo can have the engineering industries in mind, for they have vastly increased their plant capacity. He appears to think that the report of the Advisory Committee on Key Industries was not worth the cost of printing, but we hardly think that those who sit in a certain office in Kingsway will entirely agree with him. The Board of Trade was urged a year and a half ago to study every one of our 250 trades in detail, and to carefully select for development such trades as are the "most necessary, most profitable, and most practicable." We ourselves did our own little bit of urging even at that early date, and we deeply regret that it is only now that a series of specialised trade committees are beginning their inquiries. Mr. Yeo is appalled at the prospect of the great German dump, which he puts at £500,000,000. We heard a manufacturer say in public the other day that it was £300,000,000. The difference is not material—only £200,000,000—it is the menace of the dump that is the haunting spectre. We do not know upon what good authority the estimate rests—Germany is scheming a great dumping operation which may or may not affect electrical and engineering industries, that is the thing that matters. But in presence of this menace which some people, including, we believe, the Board of Trade, regard as more imaginary than real, what does Mr. Yeo advocate? Unlike Mr. Ford, he does not want to "quarantine Germany," what he wants is that the British nation shall be prepared. We quote:—

> Inhumanly though she has acted, Germany is a country of seventy million people, and she must do trade in order to compensate Belgium. . . . I do not want to encourage German trade, but I know and feel that we really must have some of her wares as soon as the conflict ceases—as little as possible, but really there is much she produces, because of low wages and great skill, in which we cannot compete. It is foolish, then, to shout about doing no more trade with Germany. Surely, it is better to make such arrangements as will secure that we are top dog.

*P. J. Ford, "Quarantining Germany."

The conclusion to which all this leads Mr. Yeo is that our prospects of trade after the war are magnificent, but they are remote because (a) we have not taken, nor are we arranging to take, the proper steps such as intelligent discrimination, &c.; (b) we are not preparing to provide ourselves with the machinery required for commercial development. We must at once alter our plans, failing which "there is ahead of this country a period of great destitution, ending only when we come to our senses."

Now before we proceed to the third stage in our consideration of these literary productions, let us note that while Mr. Ford left Germany in quarantine, Mr. Yeo leaves her people free to trade because it is natural and necessary to do so, but he wants the Government and "we," whoever may be meant, to be prepared to employ our increased labour by laying out £40,000,000 to assist British manufacturing, so that we do not buy anything from Germany that we could and should be making advantageously ourselves. Mr. Yeo is at least an advance on Mr. Ford, who simply left us strafeing.

We leave the "strafer" and the politician and turn to the philosopher.* Mr. Dunlop is nothing if not a philosopher, and though we confess that at times "much reading is a weariness to the flesh," we find his book on "British Destiny" on the whole a very interesting and profitable study, one that every thinking man in the industry, and out of it, too, would do well to study. We wish that we had more space to devote to it, for we agree with him that it is "ideas" that count in these anxious times when so many things are in the melting pot. He is unmoved by sentiment, makes us proud of our British civilisation, and sees reason to hope that we shall emerge from present disastrous happenings as a people refined in the fire, strengthened in character, more spiritual, drawn back to that high standard and tradition from which we were gradually falling until the clash of arms came, reminding us of our historic high moral standard as an example to the other nations of the earth. Mr. Dunlop leads us on through discussions on the equilibrium of society, the philosophy of co-operation, competition for quality, and the magic of industry, to a chapter on Free Trade or Protection. He has shown in an earlier chapter that a policy of reprisals is opposed to our lofty aims and traditions, and here he shows that in the matter of trade "time and energy will be wasted if we spend them in devising means of retaliation." "Methods of revenge will not promote our own national security—they will but perpetuate antagonism." "We must not be anti-German; we must be pro-British." Only a calm, collected, philosophical mind could traverse in thought with such a measured tread the bloody soil of Belgium, haunted by the abominations of terrible lust and outrage; or sail the Atlantic seas remembering the *Lusitania*; or travel among the wrecked cottage lanes of England, where babies and women were murdered by cowardly bomb-droppers, telling even the lofty British race not to be "anti-German." Pro-British yes, we will all be that, but let us be anti-German too—for a time at least. Who can help it—if he have a heart wherewith to love his friends and to hate the enemies of civilisation? But we must keep that "anti-German" spirit well in rein—that we rather imagine is what Mr. Dunlop would really ask of us. He is sufficiently anti-German—or, out of respect to him, we will say "pro-British"—to adopt a Protective Tariff as an instrument "required by present international conditions," and to be used wisely by a strong nation in order to establish reciprocity on equal terms between nations—"an instrument of negotiation"—and to finally prepare the way for international Free Trade. We presume that all the preceding chapters are intended to lead up to the scheme for Industrial Federation, which is outlined in the last. He advocates that the functions of many different organisations, each of them important in its sphere, should be co-ordinated without sacrificing or nullifying their individual work. The first step advocated is a conference of a few men with the co-operative spirit from each of the associations named, representing trade, employers, labour, scientific and learned societies, co-operative agriculture, and finance. They should establish a Federation, the general aim of which would be to preserve and promote national efficiency and the traditions and ideals which are the basis of the British Empire.

Now where do all these different writers lead us? Mr. Ford would put the enemy in quarantine until the national character is purged; Mr. Yeo says put your own house in order by encouraging essential industries; Mr. Dunlop leads us on to a high plane with noble conceptions of British destiny, and says assure that destiny by protective tariffs suited to the emergency and for the emergency alone, and by federating all the national forces of Capital and Labour, of science, industry, finance and agriculture, so as to make that destiny permanent and secure.

Do these things satisfy our industrial hunger? Are they food for men who have eaten humble pie too long, and who cast longing eyes toward an Economic Conference at Paris, who look for a compact between Great Britain and her Colonies and the Allies, who want to have more substantial relations with us in the near future? Ideas are all-important if they lead us on to right decisions when we descend to the deliberations of a practical conference of the kind that is awaited. It seems to us that one of the very first duties to be performed in connection with such a conference, or at any rate one that should follow it immediately, is an exhaustive inquiry by each of the nations engaged in it respecting their requirements in the matter of imports and their abilities in respect of exports. With such material at hand, together with some fairly reliable conjectures as to the possibilities of developing manufacture under the altered conditions that now obtain, and may probably obtain after the war, it ought to be possible to draft a practical scheme. But how can such material be ready in time unless it be now preparing?—the work would be of vast proportions. And how can such material be trustworthy unless it be prepared in part by industrial and business minds who know the factors? And how can it be well done if the Government policy be to "wait and see" until it is "too late"?

* "British Destiny: The Principles of Progress," by D. N. Dunlop, A.I.E.E.

THE SELLING SIDE OF ELECTRICITY SUPPLY.—VI.

In the first of this series of articles we devoted our space to suggestions which would be useful to those having the management of showrooms; there were a number of observations that we were inclined to make, but refrained from, as they appeared to be obvious; that they might have been made with advantage will be seen from the following account of a visit recently paid to a London showroom.

This showroom is in a good situation in a flourishing district, and a considerable amount must have been spent in fitting it out. It is a thousand pities that such outlay should be practically wasted as far as advertising the advantages of electricity is concerned. The windows were not used to any good purpose, for they only contained a few hot-wire radiators of poor design, none of them alight; the

one radiator running was a six-lamp pattern; four of the lamps were on, the two that were not alight were black and dirty. Several table standards, with tarnished metal parts and shabby silk shades, were alight. The other uses of electricity were "advocated" by a toaster and a few kettles, all of which wanted a good cleaning. Much the same state of affairs was discovered inside. The walls were sparsely covered with candelabra, of which the candles were leaning at various angles. The electric kitchen consisted of one modern cooker and several obsolete ovens; all the metal parts were dull and the insides dirty. On a table stood a disk boiler; the white cloth it stood upon was scorched in a dozen places through over-heating of the legs. There was also a very discoloured nickel-plated iron without connecter or flex. Some vacuum cleaners were displayed; perhaps the dust on the floor and the cobwebs noticed on a fitting were being preserved for the time when a demonstration could be made. The only thing the writer fancied was a very nice sideboard. On a table, prominently placed, was a selection of publicity matter in which, amongst other claims for electricity, cleanliness was prominently mentioned. Comment is needless.

Unfortunately, this is not a solitary case. It were far better if showrooms were left out, than be so badly managed as to be a discredit to the whole service.

Those responsible for such exhibitions should disabuse themselves of the idea that the selling of electricity places them in a position of inherent superiority to other businesses. Merchandising electrical accessories and apparatus to be successful must follow ordinary commercial principles. Granting that our efforts are circumscribed by the shortage of many things owing to the war, there is no excuse for running what should be an up-to-date showroom as a museum or a curiosity shop. Rather than let stock accumulate and fall behind the times, there is no reason why a sale should not be held.

It is difficult to keep many of the nickel-plated and other metal finished apparatus smart. The best and cheapest way is to effect quick sales and a rapid turn-over of stock. Our remarks in previous articles as to frequent changes in the shop-window display were apparently unread, certainly not acted upon. We have at heart the improvement in methods and scope of the business-getting side of electrical supply, and an earnest desire to assist those engaged in this work. A showroom run on slipshod lines is an offence against the interests of the industry at large, and the undertaking to which it is attached in particular. It is clearly the duty of every profit-earning department to make that profit as large as possible. To allow the publicity department to be an unnecessary burden on the current revenue is to admit the arguments of those who take an adverse view of this enterprise in salesmanship.

There is no gainsaying the fact, whatever may be the causes, that our electrical showrooms in general make a very poor showing compared to the large well-fitted and well-stocked establishments of the rival industry. Let us, therefore, strive to remedy this; new departures may be out of the question for the moment, but there is nothing to prevent the showrooms already existing from making the most of themselves. A well-thought-out plan of operations should be determined upon. Dress the windows this month with irons, and offer a free trial; next month show vacuum cleaners at work; the following month, say, toasters and kettles—demonstrate them. Let your management be characterised by vigour, enterprise, and push. In salesman talk, don't be ashamed to express the faith which is in you. Believe in what you are saying if you wish your customer to believe it too. Yours may be only a small part, but play it for all you are worth if you want a larger. Never forget the rule: "What your hand findeth to do, that do with all your might," and you will eventually find yourself on top.

Application for Extension of Patent.—An application has been made by F. G. Creed, W. A. Coulson, and Messrs. Creed, Bille & Co., Ltd., for the extension of the term of patent No 22,653 of 1902.

BUSINESS NOTES.

Bankruptcy Proceedings.—J. T. Peddie, mechanical engineer, Exhibition Buildings, Aldwych Site, W.C.—A composition of 5s. in the £ is payable on April 18th at the offices of Messrs. Elles, Salaman, Coates & Co., 1-2, Bucklersbury, E.C.

Liquidation.—Messrs. H. A. Harvey & Co., Ltd. (in liquidation).—Mr. W. A. Henderson, the liquidator of this company, intends to apply for his release; any objection must be notified to the Board of Trade within 21 days of April 14th. The receiver for the debenture-holders, having now realised all the available assets of the company, can pay a dividend to the debenture-holders only; consequently, there will be no funds for the ordinary creditors of the company, or for the expenses of the liquidation.

Catalogues and Lists.—Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street, S.W.—Folder relating to their conveyors and elevators for handling coal and ash. A comprehensive catalogue will shortly be issued.

Messrs. Marshall & Plumtree, 20, High Holborn, W.C.—Leaflets describing the "Hold-heet" electric glue-pots and cookers, fitted with thermostats to keep the temperature constant at the right value, in various sizes, and the "Clearway" electric horn.

Book Notices.—"Elementary Strength of Materials." By E. S. Andrews. London: Chapman & Hall. Price 4s. 6d. net.

The *Wireless World* for April has assumed a new cover, on which is represented the latest type of mast arrangement for receiving stations; the contents have also undergone rearrangement, and include a variety of interesting articles, technical and otherwise. It is a very "live wireless" production.

The Caxton Translations Institute, of Caxton House, S.W., has issued a wall card giving brief but useful information respecting the different countries of the world—populations, imports and exports, ports, consulate address in London, &c.

We have received an advance copy of the Special China Number of the *Manchester Guardian*. A number of interesting articles serve to emphasise the greatness of the market and its opportunities for engineering and other traders.

Trade Announcements.—Messrs. F. Paine & Son, electrical and mechanical engineers, have removed to larger premises at 21, Old Road, Frinton-on-Sea.

Messrs. Austin Walters & Son have removed to larger premises owing to expansion of business. The new works at 57, Lower Mosley Street, Manchester, are five times as large as the old. A new department which has been fully equipped, regardless of expense, for the repair and rewinding of all types of armatures A.C. and D.C. has been opened, and the firm is specialising in traction work. The works have modern drying stores, and special attention is given to the careful test of all repair work.

LIGHTING AND POWER NOTES.

Accrington.—Plant Extensions.—At the General Purposes Committee, on April 13th, communications were read from the L.G.B., &c., intimating that sanction had been given to the scheme for the extension of the electric generating plant and the erection of a new chimney and flues in connection with the destructor. The new generating plant will cost £14,000, and the boiler, chimney and flues £7,000. It was decided to proceed with the work. The provision of a tubular boiler, at a cost of £3,000, was regarded as unnecessary, and has, consequently, been dropped for the time being.

Altrincham.—New Plant.—The Altrincham Electric Supply, Ltd., has successfully put into commission its first turbo-alternator set, which is one of 1,850 K.A.A., supplied by the B.T.H. Co., with a Cole, Marchent & Morley surface condenser and Rees-Roturbo pumps.

Argentina.—The Government of the Province of Cordoba has authorised Messrs. Trelsi and Riesco to install and exploit an electrical service at Villa Huidobro, Department of General Roca.

Australia.—The gross revenue of the Melbourne City Council's electric supply undertaking for the year 1915 was £182,594, an increase over the previous year of £17,806; the expenditure was £82,745, leaving a gross profit of £99,849. The revenue derived from private and bulk supplies increased by £17,736; from private lighting the increase was £70. The increase in revenue from bulk supplies to adjoining municipalities amounted to £2,122, notwithstanding a considerable reduction in the price of current. Interest payments amounted to £22,219; and contributions to the sinking fund and depreciation and reserve fund absorbed £7,471 and £33,512 respectively. The net profit for 1915 of £35,569 was in addition to interest on capital and sinking fund charges, which together represented a return of over 10 per cent. on the £654,000 borrowed. The Electric Supply Committee in its report points out the desirability of forming a reserve fund for depreciation of machinery and non-remunerative expenditure, such as the storage of coal; £29,000 had been contributed to the town fund, including £2,200 deficiency in the lighting rate, the total contributions to the fund to date amounting to £108,645. The Committee proposes to transfer £165,394 from the depreciation and renewal fund,

and to write down capital expenditure by that amount, thereby reducing it to £581,748, and leaving at the credit of the renewals fund £55,131.

Barton-on-Humber.—Street Lighting.—With reference to the dispute between the U.D.C. and the Electric Supply Co. over the public lighting account, the Council has decided by 10 votes to 6 to pay the amount claimed, less 10 per cent., without prejudice. The L.G.B., in declining to express any opinion on the matter, referred the Council to the remarks of Mr. Justice Low, in the Leiston case.

Continental.—Portugal.—A Bill has been presented to the Chamber of Deputies to authorise the Municipality of Amarante to contract a loan of about £17,500, to be devoted to a hydro-electric installation for the production of power for lighting and other purposes.—*B. of T. Journal.*

Spain.—The Ministerio de Fomento has granted permission to Don Tomás Garmendia to utilise the waters of the Reburdiejos and Sejos streams, in the district of Los Tojos (Province of Santander), for the production of electric power for industrial purposes.—*B. of T. Journal.*

Application has been made for a concession to put down a plant to utilise the water power of the river Mendo, near San Pedro de Oza, in the generation of electrical energy for lighting and power purposes in the town named and surrounding neighbourhood. A derivation canal about a mile and a half in length will be necessary in connection with the plant.

Gravesend.—Price Increase.—The T.C., owing to the continued advance in the price of coal, has decided to add 25 per cent. to consumers' accounts from the quarter ending March 31st, the increase to be reduced to the original advance of 10 per cent. when fuel costs less than 25s. per ton.

Ilford.—Street Lighting, &c.—The estimate in respect of public lighting for the ensuing six months, just approved by the Electricity Committee, shows an allowance of £1,000 for reduced lighting. The chairman of the Committee and the electrical engineer have been authorised to place orders for an additional 1,000 tons of coal for delivery over the next four or six months.

Ivybridge (Devon).—The local Electricity Supply Co. has leased Union mills for its undertaking.

London.—Poplar.—The Electricity Committee is of opinion that a temporary increase of prices for current for power and public lighting purposes is necessary, and has fixed the increase at 10 per cent. as from April 1st last. It is estimated that the proposed increase, after making allowance for probable decreased demand, will enable a surplus of not less than £5,000 to be earned, while if coal is obtained at 2s. 6d. per ton less than estimated, the estimated surplus would be raised to £10,000 for the ensuing year. An annual surplus of not less than the latter sum is required to meet all demands upon the undertaking, and maintain the policy of providing for the cost of new services, meters, &c., and the writing down of plant out of revenue. It is not considered desirable to increase the charges for private lighting. The Committee proposes to adopt, experimentally, the Cumberland electrolytic process on a Babcock boiler and economiser at the works, at a cost of £200. Should the process achieve the results claimed for it, the Committee anticipates that the cost of installation can be met within a year. The Council has been recommended to grant a war bonus to the staff of 10 per cent. on present normal salaries and wages (including emoluments) under £200 per annum; 7½ per cent. on £200 and under £300, and 5 per cent. on £300 and upwards. In the case of the electricity department, it is proposed that those who have received a war bonus, or increase due to the war, should have the amount made up to 10 per cent., and should a profit bonus be available at the end of the ensuing year, the aggregate amount paid as war bonus during the year, as proposed, will be deducted from each individual share in profits.

Islington.—The Lighting Committee has adopted the electrical engineer's suggestion that during the war certain arc lamps should be altered by substituting high c.p. metal-filament lamps in the globes. The annual saving, exclusive of energy, will amount to £85 per annum.

L.C.C.—The Finance Committee recommends the Council to sanction the borrowing by the Bermondsey B.C. of £2,773 for electricity purposes, being £978 for mains, £1,410 for house services, and £385 for meters; also that sanction be granted to the Stepney B.C. to borrow £3,000, being part of the cost of the two new boilers in connection with the electricity undertaking; and to the Woolwich B.C. in regard to £27,115 for plant, and £385 for mains.

Manchester.—Tenders in connection with the scheme to increase the output of the Stuart Street electricity station have been approved. Mr. Pearce, the electrical engineer, submitted at a meeting of the Sub-Committee the total estimated capital cost of the scheme at £30,000.

Middleton.—Street Lighting.—The town clerk gave notice, on the 13th inst., that the charge for current for lighting purposes has been increased by ½d. per unit, and that for power and heating purposes by 12½ per cent.

Radcliffe.—Year's Working.—It was reported, at a meeting of the U.D.C. last week, that there was every possibility of a small net profit resulting from the year's trading of the electricity department.

Swinton.—Price Increase.—The U.D.C. has decided that owing to the extra cost of current, the charge to consumers be increased by 12½ per cent. It was stated that a Sub-Committee is to review the conditions on which consumers are supplied, and where it is found that they were served at a loss steps would be taken to terminate the contract and make fresh arrangements.

Ulverston.—E.L. Scheme.—The R.D.C. has agreed with the Coniston Electric Lighting Co. as to the basis of the terms for electrically lighting the village of Coniston. No higher rate than 8d. a unit is to be charged, and the Council will have the option of purchasing the undertaking at any time after 10 years at the fair market value. The Council was also recommended that the proposed agreement shall contain a clause preserving the right of the Rural District Council or other local authority, or any company or person, with the consent of the local authority, to obtain a licence or provisional order.

Watford.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for a loan of £3,300 for electrical supplies needed for war purposes.

TRAMWAY and RAILWAY NOTES.

Australia.—The half-yearly report of the Adelaide (S. Australia) Municipal Tramways Trust, to January 31st, 1916, shows that the net revenue was £63,401, the full statutory charges being £64,579, leaving a deficit for the half-year of £1,322. The gross revenue for the half-year was £160,463, or £7,180 more than in the preceding half-year, and £3,313 more than in the corresponding half-year ended January 31st, 1915. The capital cost of the revenue-earning portion of the electric traction system, excluding purchase money and stores, was £1,447,584. The surplus revenue over operation expenses (excluding the Port Adelaide horse-car account), was £63,401, and the percentage of working expenses to revenue was 60·333. The surplus revenue over operating expenses equalled 8·758 per cent. on the capital cost. The reserve fund for renewals now amounts to £97,426, and the insurance reserve to £7,926.

A motion by the Minister of Public Works, in the N.S.W. Legislative Assembly, that a bridge should be constructed to connect Sydney and North Sydney, at a total cost of over £3,000,000, was recently agreed to by 42 votes to 8. The bridge would carry a double electric railway track, double tramway track, vehicle and motor roads, and a footway.

Belfast.—At a meeting of the Tramways and Electrical Committee last week, it was intimated that at the present time there were 297 motormen and 298 conductors in the service of the Corporation. Of these 227 motormen and 182 conductors were in the service before the war, and 70 motormen and 116 conductors had volunteered into the Army—most of them for the famous Ulster Division. Only four unmarried men of military age have joined the tramway department since the war started, 52 under military age, and a number of over-age men, and some medically unfit and discharged soldiers.

It has been decided to give the new manager of the tramway system—whoever he may be—an annual salary of £800. The original figure mentioned was £700.

Croydon.—Strike.—On Monday, the T.C., by 34 votes to 17, refused an amendment to refer the matters in dispute with its tramway employés to arbitration. A further amendment, referring the matter to the arbitration of five local gentlemen, was lost by 26 votes to 22. There are 163 employés on strike, and 25 have remained loyal to the committee.

L. & Y. Railway Electrification.—The new electric train service between Manchester and Bury, on the Lancashire and Yorkshire Railway system, was inaugurated on Monday.

London.—The Holborn B.C. offers no objection to the application of the L.C.C. to the B. of T. for an extension of time for the construction of a junction line to connect the existing tramways in Clerkenwell Road with those in Farringdon Road.

Southport.—Female Labour.—The Trades Council has decided to send a protest to the Corporation against the employment of women as tramway drivers. One member of the Council stated that, as one who had driven a car, he could unhesitatingly say that the job was not one that was suitable for women.

Sunderland.—The Tramways Committee recommended: "That on and from the 1st inst. the war bonuses be payable to employés in the tramways department varying from 2s. to 3s. 6d. per week, and that no employé shall receive, by reason of such bonus, a sum in excess of 50s. per week, including emoluments, and that the wages of tramway inspectors be advanced from 7d. to 7½d. per hour." It was stated that the advances recommended would mean an additional wage expenditure of £78 a year and the temporary advance in respect of bonuses of £624 a year. An amendment that the bonus recommendations should be struck out was lost by 27 votes to 3.

Worsley.—The U.D.C. is petitioning the South Lancashire Tramway Co. for the provision of additional shelters.

TELEGRAPH and TELEPHONE NOTES.

Australia.—Wireless telegraphy throughout the Commonwealth will in the future be under the control of the Navy, and all men employed will wear uniform and belong to the "Royal Australian Navy Radio Service." This is a new branch of the Australian Navy. At present there are about 120 employés, many of whom were taken over from the Postal Department by the Navy Department in October last. It is intended at a later date to appoint an engineer for radio-telegraphy for the Commonwealth. In the meantime, Engineer-Lieutenant F. G. Creswell will be acting, and the Minister for the Navy has made arrangements with Mr. J. G. Balsillie for him to have a retaining fee as consulting engineer for six months.

Wireless by Gramophone.—At the suggestion of the Marconi Co., gramophone records are now being made which reproduce the Morse signals as they appear in the microphone of a wireless receiver. These records commence with the simple Morse code, pass on to dummy messages, including figures, fractions, Stock Exchange terms, and other items of business importance, and culminate with examples of "jamming."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—May 24th. N.S.W. Government Railways and Tramways. 16/600-volt D.C. motors for tramway stores, Randwick.*

Melbourne.—April 26th. Victorian Government Railways. Car-lighting material—cables, switches, fuses, &c.*

May 1st. City Council. Meters and maximum-demand indicators. See "Official Notices" April 7th.

May 10th. Victorian Government Railways. Motor-generator set and accessories for battery-charging of baggage trucks.*

May 17th. Victorian Government Railways. One 2-ton electrically-operated goods elevator for Jolimont car-shed.*

New Zealand.—June 23rd. Oamaru Borough Council. Overhead mains and street-lighting equipment (Contract No. 2); power-station equipment (Pelton wheels, alternators, &c.) (Contract No. 3); service meters (Contract No. 4); line transformers and accessories (Contract No. 5).*

Salford.—May 8th. Electricity Department. High-pressure steel steam pipes and separator, also cast-iron pipes and valves. See "Official Notices" to-day.

Walthamstow.—April 26th. U.D.C. Water-softening plant for the Electricity Department. See "Official Notices" April 7th.

Warrington.—April 26th. Electricity and Tramways Committee. Boiler plant and economiser. See "Official Notices" April 7th.

West Hartlepool.—April 28th. Electricity Department. Two water-tube boilers with superheaters and mechanical stokers. See "Official Notices" April 14th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Barnes.—The tender of the Pirelli General Cable Works, Ltd., has been accepted by the U.D.C., at £188, for 440 yards of three-core distributing cable.

Burnley.—B. of G. Electrical requirements: Messrs. F. Thornton & Co.

Dundee.—The T.C. has accepted the tender of Messrs. Venner Time Switches, Ltd., for time switches for the coming year, and that of Messrs. Chamberlain & Hookham, Ltd., for meters.

London.—L.C.C.—Seven tenders have been received for the construction of foundations, &c., for the third additional turbo-generator at the Greenwich generating station:—

W. Downs, Ltd.	(accepted)	£4,751
W. Manders & Co.		4,927
G. Godson & Sons		4,980
J. Jarvis & Sons, Ltd.		5,290
J. E. Whiter & Co.		5,449
James Ford		6,450
Charles Wall, Ltd.		6,853

Architect's estimate, £4,500.

The Stores and Contracts Committee recommends that the Committee or the chairman or the vice-chairman of the Committee be each authorised during the Easter recess to open tenders for the supply of electric traction glow-lamps for the Tramways Department.

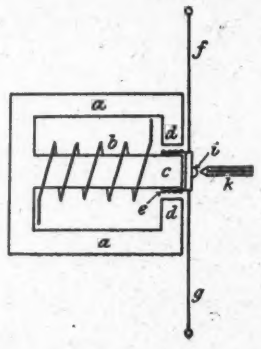
FORTHCOMING EVENT.

Belfast Association of Engineers.—Thursday, April 27th. Annual General Meeting.

A SENSITIVE RELAY FOR WIRELESS TELEGRAPHY.

Though a great deal of energy has been expended in devising relays to make possible the calling and autographic recording of wireless messages, there is still plenty of room for fresh devices, and the relay illustrated diagrammatically in the accompanying figure presents a number of interesting features. It is claimed that the new instrument is superior to Dary, Ducretet and Brown's relays in respect of natural frequency and sensitivity. As described by E. Leimer in the *E.T.Z.*, the instrument consists essentially of a separately excited pot magnet, in the narrow air gap *d c* of which there is a coil *e*, consisting of several hundred turns of No. 50 insulated copper wire, wound in one layer on a pot-shaped celluloid former, which is carried by fine metal wires *f*, *g*, serving also as leads. The celluloid former moving with small clearance on the centre pole *c* provides damping, and the wires *f*, *g*, terminating on torsion and tension screws, provide a free suspension adjustable for sensitivity and frequency. Either a third wire parallel to *f* or *g* (in which case torsion screws are unnecessary), or a fine wire spiral carries relay current to a platinum contact *i*, opposite which is an adjustable contact screw *k*.

The relay is in effect a thread galvanometer, and is connected in the detector circuit. It can be made to respond to 4 microamperes when adjusted to a natural frequency of 0·5 second. In normal



working, natural frequency and sensitivity are adjusted, so that certain relay contact is made with about 25 microamperes in the moving coil. Limiting the permissible heating of the coil *b* to 40° C. in half an hour, a field of about 18 000 gauss is obtainable in the gap *d*, *c*. Varying this field provides 1 : 1·5 or so variation in sensitivity, and the latter can be more than doubled again by the use of 0·02 mm. silver wire, instead of 0·03 mm. copper wire, in the coil *e*. Such fine silver wire can be insulated sufficiently for the present purpose by coating with a carbon-bisulphide lacquer, or by blackening in solutions containing carbon-bisulphide or sulphuretted hydrogen.

In this and similar relays certain precautions are necessary to prevent sticking at the relay contacts. The moving contact should be a domed disk of burnished platinum of very small diameter, and the stationary contact should be tipped with a fine platinum wire, pointed and polished. The whole instrument should be spring-suspended under a dust-tight glass bell, and the local current controlled by the relay contacts should not exceed 100 microamperes at 1·5 volts; this current may be used to operate a step relay actuating a Morse printer. The inductance of the step relay must be neutralised by a non-inductive resistance in parallel and by a condenser across its contacts. Only by this means and by removing the step relay, Morse printer and current-carrying leads as far as possible and by bifilar winding of the spiral connecting to the contact *i*, can the main relay be kept reasonably free from outside influences when set to maximum sensitivity. The sensitivity of the primary relay may be appreciated from the fact that it records the ringing of a house bell, whose circuit passes 25 ft. away from the wireless installation, and the starting and stopping of electric tramcars 500 yards away.

The relay is only suitable for use with electrolytic detectors; crystal detectors give no results. By using two or more electrolytic detectors in parallel the relay can be made to record signals which do not affect it when a single detector is used; telephone reception weakens as the number of detectors is increased. For example, a single electrolytic detector received eight microamps. from Clifden (780 miles), but five detectors in parallel and balanced among themselves by potentiometer adjustment gave 30 microamps. and good relay working, though with some elongation of dots. As few detectors should be used as will give good relay working.

A novel suggestion worth investigation is that a sensitive mirror galvanometer be used to throw light on or off the vanes of a "light-mill" or radiometer, the latter operating adjustable contacts, say, by magnetic effect.

NOTES.

Australian Engineers for Australia.—According to the *Melbourne Age* of February 26th, a competitive examination, held by the Government authorities for the purpose of selecting an electrical engineer for the telephone branch in Adelaide, at a salary of £528 a year, has resulted in the appointment of Mr. R. Lawson, formerly assistant engineer on the staff of the chief electrical engineer. Nine officers competed, and Mr. P. Kennedy, of Western Australia, was second on the list. The examination was held as the result of a protest by the Professional Officers' Association against the appointment of imported officers over the heads of Australians. The Postmaster-General decided that the merits of all officers should be tested. Mr. Lawson is an imported officer.

Complaints are being made in Australia with regard to the appointment, it being alleged that imported candidates were favoured, to the detriment of Australians, in the examination. An impartial inquiry into the circumstances is demanded by Commonwealth engineers.

One Too Many.—Owing to our having to proceed to press two days earlier than usual, we are unable to include the following letter in our "Correspondence" columns:—

As "one of the speakers who is connected with the electrical trade" referred to by you in your last week's issue under the above heading, I was very pleased to read your article, which, though somewhat severe in its criticisms, I gladly welcome as written with that frankness and openness which cannot fail to assist our common aim, viz., to bring about a complete commercial as well as a military victory over our enemy.

Let me assure you that the "British Manufacturers' Association, 1915" should be entirely acquitted of any narrow or one-sided views such as the article in question imputes to them, and the absence of any reference to efforts emanating from other sources was not due to any petty jealousy.

The Association is not unmindful of such other movements as you refer to, but, to imitate your own perfect frankness, it fails to find in them that "substantial progress" of which you speak.

I entirely agree with your argument that one strong representative organisation is what is needed, and this is indeed exactly what I advocated, but it must be strong in business ability and determination to act, and must not rely for its influence and standing on an executive composed of men of title or mere party speakers—enlisted as such—apart from any fitness for the real objects of such an organisation.

It was with these points in view that the British Manufacturers' Association was formed, and it is more than ready to act in union with any movement, old or new, that will tackle firmly and imperially the position which confronts us.

I trust you will do me the favour of inserting this letter in your widely read paper, in the hope that it may elicit criticism and exchange of views, useful to all those who are willing and anxious to help in these times to secure Britain for the British.

ARTHUR BERKELEY, M.I.E.E.

London, E.C., *April 17th*, 1916.

Electrochemistry in the United States.—The Niagara Falls section of the American Electrochemical Society in February discussed the development of power from the Falls in connection with the electrochemical industries. According to *Metallurgical and Chemical Engineering*, complaints were made with regard to the restriction of power development at Niagara by the U.S. Government. It was stated that the Niagara Falls Power Co. generated 90,000 H.P., and the Hydraulic Power Co. 100,000 to 125,000 H.P., all the latter, except 15 000 H.P., being employed in the electrochemical industries. Mr. F. J. Tone said that the year 1915 had taught them that a nation must be economically and industrially independent and self-contained. Crude potash, formerly obtained from Germany, had risen from £7 to £80 per ton; ferromanganese, derived from England, had been placed under an embargo, and its price had risen from £7·6 to £25 per ton, while many commodities had become almost unobtainable. Few realised to what extent their great basic American industries depended upon electrochemistry, particularly the electrochemical products of Niagara power. Steel manufacture, the greatest of all American industries, was absolutely dependent upon Niagara power for ferro-alloys; ferrosilicon was an essential element in the production of 15 million tons of steel; ferrochromium, ferrotungsten, and ferrovanadium were indispensable to the manufacture of high-speed tool steel, while ferrochrome was the hardening element in armour-plate and armour-piercing projectiles, and electrical transformer steel was equally dependent upon the products of Niagara power. Artificial abrasives to the amount of 20,000 tons a year were produced at Niagara, and were indispensable to many industries; aluminium and calcium carbide were the largest of the electrochemical industries at Niagara; nitrogen fixation works had been established on the Canadian side of the river, but employed only 25,000 H.P., whereas in Europe over 300,000 H.P. was devoted to the production of nitrogen fertilisers. For the spectacle of Niagara they were paying the price of a million tons of coal a week.

It was stated that from 125,000 to 150,000 H.P. was transmitted into the United States from the Canadian side, and that the continuance of this supply depended upon permits revocable by the Canadian Government. The generation of large quantities of additional power at Niagara on the American side was the only way to avoid a "frightful dislocation of American industry." The development of the electrochemical industries had been the salvation of Germany, and should equally be undertaken by the United States as a matter of preparedness in national defence.

Late Legal.—READ *v.* STELLA CONDUITS CO.—The Court of Appeal, composed of the Master of the Rolls, Lord Justice Phillimore, and Mr. Justice Sargant, have delivered their reserved judgment on the appeal by the plaintiff in the action of Read *v.* The Stella Conduits Co.

The action was brought for an injunction, damages, and the usual ancillary relief for the alleged infringement of Letters Patent No. 18,375, of 1905, granted to James William Brooks and Albert Edward Read for "an improved means for connecting tubular electrical conduits together, and for connecting the said electrical conduits to the fittings without screwing.

Mr. Justice Joyce held that the gripping arrangement was a well known and common one, and that as there was no invention in the patented appliance the patent was invalid. He therefore dismissed the action, with costs, and the plaintiff appealed from this decision.

The arguments upon the appeal concluded upon March 30th, when their Lordships reserved judgment.

Mr. Justice Sargant, who read the judgment of the Court, said that apart from one small variation the plaintiff's appliance was the same whether it was used for connecting a tube and a fitting or connecting two tubes, and, in the latter case, whether the two tubes were of equal or unequal diameter. What, therefore, was the invention as claimed by the plaintiff? So far as each function taken by itself was concerned, the method described in the plaintiff's specification was undoubtedly old. No doubt, however, in view of that fact the refreshingly short and intelligible claim in the plaintiff's specification was not for a method or appliance for effecting a simple single junction or connection of this nature with one tube, but for an appliance for connecting together the ends of two tubular electrical conduits or fittings in the manner described. Did this double connection, as distinguished from a single connection, disclose sufficient subject matter or sufficient invention to support the plaintiff's letters patent? In the opinion of the Court it did not.

The judgment of the Court below was therefore right, and the appeal must be dismissed, with costs.

On Monday an action by the Pritchett & Gold and Electrical Power Storage Co., Ltd., against Hamble, River, Luke & Co., Ltd., with reference to a contract for an electrical installation at the premises of a Mrs. Currie, began hearing before Mr. Justice Sargant. The hearing was adjourned.

Fatalities.—An inquest was held at Eston, on Wednesday last week, touching the death of Charles Morgan, an electric crane driver, who succumbed to injuries sustained at the Cleveland Steel Works of Messrs. Bolckow, Vaughan & Co., Ltd. John Steel, a crane driver, stated that he examined deceased's crane immediately after the mishap. Morgan had apparently stepped out of the cabin on to a beam, and had not taken the precaution to switch off the current. He had then evidently come in contact with a live wire, the resulting shock causing him to fall a distance of 40 ft. to the ground. William Anderson, electrical engineer, said the wires conveying current to the cranes could not be covered, and there was an alternating pressure of 440 volts. Dr. J. Steel deposed that Morgan's case was hopeless. Death was due to the shock from the fall, although it was very probable that the electric shock alone would have caused death. Verdict, "Accidental death."

Arthur Henry Booker, an electrical engineer employed at Messrs. Cammell, Laird's works at Sheffield, was recently killed owing to a plank, which fell from scaffolding on the roof of the power station, striking him on the head. At the inquest the verdict was "Accidental death."

Zinc Smelting in Norway.—H.M. Minister at Christiania states that the electrical refining of zinc has been developing on a gradually increased scale at Trollhattan for some years past, and has now reached an output of over 6,000 tons of refined zinc per annum. The ore is first smelted in the raw-material furnaces, and the ordinary spelter thus produced is then re-distilled in the refining furnaces. Refining is also being carried on at Sundlokken. For some time past plans have been discussed for increased facilities for smelting the ore, and it has now been decided to secure the necessary water power from the Glomfjord waterfalls, situated in Nordre Helgeland, in Nordland. These falls have been purchased by a company formed for the purpose, and when fully harnessed are calculated to yield 125,000 H.P. The works are expected to be completed by 1918, and the hydraulic power obtained will be used for smelting the ore and the refining process connected therewith.—*Board of Trade Journal.*

American General Electric: Bonus to Employés.—The General Electric Co., U.S.A., has announced that all employés in the service of the company for a period of five years or more will receive a bonus of 5 per cent. of a year's salary, payable in two instalments. This will mean a distribution of over $1,000,000 per annum to employés. The first instalment will be payable on or before August 1st of this year, and will be a sum equivalent to 5 per cent. of the individual earnings for the six months ending June 30th, 1916. By the arrangement of two payments many employés, who would not be entitled to participate in the distribution if all were paid in one instalment, will share in the second distribution, having completed the five years' service between June

30th and December 31st. The distribution, as stated by officials of the company, is being made by the company to signify its appreciation of the services of the employés who have been with the company for a term of years, and is a result of a desire to promote long, faithful and efficient service by its employés.—*American Electrical Review.*

L.C.C. Tramway War Bonuses.—The Rolling Stock Conciliation Board has considered the claims of the several grades of men in the rolling-stock section of the L.C.C. tramways to the war bonus of 4s. a week, and finds that the moulders belong to a class dealt with by a decision of the Committee on Production dated April 17th, 1915, and that the other grades belong to a class dealt with at the conference on April 21st, 1915, and the Board therefore awards them the advance of 4s. per week as war wages.

A question having arisen as to the grades included in the memorandum of the conference of April 21st, 1915, the matter was submitted to the London and District Association of Engineering Employers and the London, Erith and Southall District Allied Engineering Trades Joint Committee. Having considered the replies of these two bodies, the Conciliation Board has decided that an advance up to 4s. a week, to be regarded as war wages, shall be paid to the undermentioned grades of employés in the rolling-stock section :—

Armature winders, wiremen, magnet and coil winders, armature banders, controller testers, body-makers, coach-painters, brush-hands, solderers, light and power attendants, controller repairers, machinery greasers, car greasers, stokers, plough repairers, locomotive drivers, crane drivers, steam lorry drivers, plough changers, controller and motor cleaners, assistant brakesmen, truckmen, brakesmen and re-wheelers, writers, carpenters, wheelwrights, coach-trimmers, shunters, labourers (wood-working, electrical and mechanical), leading labourer (mechanical), tool-store attendants, traversermen, gate constable and patrol constable.

Except as regards armature winders and wiremen, the payment of the advance is to be made as from the first pay-day in March, 1916.

The payment of the advance to armature winders and wiremen is to be made as from the first pay-day in September, 1915.

Australian Electrical Contract Conditions.—With reference to the note appearing under this title in our issue of January 7th, Mr. R. H. Butler, secretary of the Australian Electrical and Allied Contractors' Committee of Melbourne, writes correcting the statements which we reproduced from an Australian contemporary. Mr. Butler says that the whole of the information is quite erroneous, and that his Committee "undertook the work of preparing conditions of contract to be applied to electrical and engineering contracts in Australia, and having drawn up a set of conditions, submitted them to the Federal Council of the Electrical Association of Australia, which body approved of them with slight amendments. The report of the *Australian Mining Standard* reverses the origin of these conditions by attributing them to the Electrical Association of Australia, and stating that they had been approved by representatives of electrical contractors."

The Royal Mint Report.—The Deputy Master, Sir Thomas Elliott, in his report for 1914, shows that the activities of the Mint were such that the previous record production of coins in 1913 was exceeded by more than 28 millions. Of the total coinage of 213 millions in 1914, 188 millions were for Imperial, and 25 millions were for Colonial issues. The Imperial coinage consisted of 19 million gold, 92 million silver, and 77 million bronze pieces.

The memorandum of Sir Edward Rigg, superintendent of the operative department, states that over 2,300 tons of metal were converted into coinage bars, this figure being more than double the average of the previous 10 years. In the machinery branch, the staff has been considerably supplemented and employed since August in the year under review on special work undertaken by the department. The electrical plant has been subject to a steady increase in the demands made upon it. Motors in use number 106 (gross H.P. 950), as compared with 102 (gross H.P. 877) in 1913. The extended use of high candle-power incandescent lamps has led to a reduction in the number of arc, flame, and silica lamps from 64 to 57. The number of incandescent lamps in private residences in the Mint—121—remains unchanged, but those in official use have been increased from 1,151 to 1,298, mainly in consequence of the local lighting requirements for new machine tools in connection with the special work referred to above. The average monthly output of the Mint generators for the year—39,917 Board of Trade units—is 5,600 units above that for 1913.

In the Inland Revenue department, 1 copper, 173 nickel and 232 steel-faced electros were grown, in connection with the preparation of postage stamp plates and dies for postcards and wrappers. The work of preparing master plates and electros of the prisoners' inscriptions in the Tower of London (see Elec. Rev., October 13th, 1914, page 566) has been completed. In all, 458 electros and 66 master plates were produced, the total area of the former amounting to 332·8 sq. ft.

Sir Thomas Rose, chemist and assayer, in his memorandum, refers to the question of electrolytic refining of gold. The main drawbacks to the process at present are the length of time occupied, and the consequent impossibility of bringing the metal in a refinery to account daily. From experiments he has made in the department, he states that it would appear that by the use of an electrolyte containing 20 per cent. gold in the form of chloride, and 30 per cent. free hydrochloric acid, a current of 5,000 amperes per sq. metre can be employed, instead of the 500 to 1,000 amperes now used with weaker baths. With this heavy current the percentage of silver in the anodes is of comparatively little importance, and the silver cells can be dispensed with in most cases, and, in addition, 80 or 90 per cent. of the time required in the gold cells can be saved. Under these conditions, the rough gold can be refined and brought to account within the limits of each working day.

Mr. A. Ventris, superintendent at the Perth branch, reports that on account of the extended use of compressed air for other purposes than the original one in connection with gold refining, a 10-H.P. motor has been fixed in place of one of 5 H.P. originally employed. An automatic controller, for regulating the speed of the motor-driven blower, has also been installed in the melting-house office. A hand regulator was formerly used in the blower room, but proved unsatisfactory, as the resistance units were destroyed by the action of chlorine. The new apparatus, which was made locally, has given good results, and maintains a uniform air pressure in the main, irrespective of the number of furnaces used.

In the memorandum of the assayer of the Ottawa branch, Mr. R. Pearson, it is stated that a trial has been made of the gold-plated silver hooks and strips referred to in the previous report (see Electrical Review, October 23rd, 1914, page 566). The strips were found to be quite as efficient as those made of fine gold. That portion of the hook which passes through the hole in the end of the anode (and is virtually a part of it), is only ½ in. distant from the warm electrolyte. The moist hydrochloric acid fumes condense there, and, under the influence of the current, in about one month dissolve the gold plating, and the silver becomes coated with silver chloride, thus increasing the resistance to the passage of the current. It is intended to use plated strips in place of fine gold in future.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The annual meeting of the Newcastle-on-Tyne Local Section of the Institution was held on the 10th inst., Mr. P. V. Hunter presiding. The report of the Committee stated that the membership had not been greatly affected by the war except in the Students' Section. The average attendance of members had been slightly better than in the preceding session. With regard to the Tees-side Section, the report stated that owing to the war no meetings had taken place. The following were the officers elected for the ensuing session for Tees-side :—Chairman, Mr. M. G. S. Swallow ; vice-chairmen, Messrs. H. G. A. Stedman and J. Pigg ; Committee, Messrs. L. F. Haslam, R. M. Longman, J. R. P. Lunn, C. E. Taylor, J. Wright, and G. N. Wright ; joint secretaries, Messrs. P. S. Thompson and C. O. Bretelle. Many members of the Newcastle Local Section and associated Sections hold commissions in H.M. Forces, or are otherwise engaged in the prosecution of the war, and the Committee regretted to announce that one member of the Local Section, Second-Lieut. W. Winkworth, had already laid down his life for his country. The officers elected for the next session were as follows :—Chairman, Mr. H. W. Clothier ; vice-chairmen, Messrs. A. H. Marshall, A. P. Pyne ; Committee, power supply undertakings, Messrs. W. F. T. Pinkney, G. L. Porter ; manufacturers and contractors, Messrs. T. Carter, W. Cross, W. G. Guns, J. H. Holmes, M. G. S. Swallow ; Post Office, Mr. F. G. C. Baldwin ; technical colleges, Mr. W. T. MacCall ; borough electrical engineers, Messrs. H. S. Ellis, C. Turnbull ; consulting engineers, Messrs. J. R. Beard, R. W. Gregory, W. C. Mountain, G. Stoney ; North-Eastern Railway Co., Mr. H. Henderson ; hon. treasurer, Mr. C. Vernier ; hon. secretary, Mr. J. R. Andrews ; assistant hon. secretary, Mr. G. L. Drury ; hon. auditors, Dr. W. M. Thornton, Mr. E. Fawsett. Dr. Thornton afterwards delivered a short technical address.

Ipswich Engineering Society.—At a meeting of the Society last month, Prof. A. Humboldt Sexton gave a lecture on fuel economy and gaseous fuel, in the course of which he emphasised the extreme importance of economy in the use of coal. He recommended water-gas as the best fuel gas obtainable, and looked forward to the time when the domestic use of coal would cease, and the smoke nuisance would disappear.

Royal Institution.—Recently Dr. Strahan, Director of the Geological Survey of Great Britain, lectured before the Royal Institution on the search for new coalfields in England. He pointed out that much progress had been made in developing the concealed coal measures of Yorkshire, Nottinghamshire, Denbighshire, and Kent. The latter was peculiar in that it was concealed everywhere. Referring to our happy-go-lucky methods of coal mining, under which it was not necessary to publish any record of borings, he mentioned that for a time the only published account of the Kent borings appeared in a German publication, and to-day some of the boreholes are not described anywhere else.

Homerton Sawmills.—On page 390, in our article on Mr. Sherry's sawmills, an error occurred in the specification ; for "50 per cent. overload for an hour and a half," read "50 per cent. for half an hour."

Municipal Loans for Storage Batteries.—The Local Government Board has, on an application made by the B.E.A.M.A., extended the period for the repayment of loans in respect of storage batteries from seven years to ten years, satisfactory guarantees being given.

Appointments Vacant.—Engineer-in-charge (45s. to 50s.), for the Northern Command, Catterick Camp ; shift engineer, for the Northampton Corporation tramways. Belfast Corporation is to appoint a new general manager of the tramways, at a commencing salary of £800 per annum ; "An Irishman Preferred."

Australian Preference.—At a meeting of the Sydney City Council, in February, the following proposal was discussed:—"That during the present war a 30 per cent. preference be given to goods manufactured by British companies on the price *ex* works, and a 10 per cent. preference be given to goods manufactured by allied companies."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Sydney City Council has been discussing the appointment of a deputy-manager of the electricity supply department. The proposal to appoint Mr. P. T. DAVIES, of Montreal, to the position was referred back by 12 votes to 11. The qualifications of Mr. S. J. MALING, of the Melbourne electricity department, have also been reported upon.

Mr. J. P. CROWTHER, electrical engineer to the Worksop U.D.C., has enlisted in the Electrical Corps of the Royal Engineers.

The Ashton-under-Lyne T.C. has agreed that the salary of Mr. HOLT, the tramways manager, be increased from £200 to £260 per annum, the amount paid to his predecessor.

Mr. HARRY PILLING, manager of Accrington Corporation Tramways, appears in the list of nine selected candidates for the general managership of Oldham Corporation Tramways.

Second-Lieutenant JOHN SEEAR GIBSON, A.M.I.E.E., Royal Sussex Regiment, charge engineer at the Tunbridge Wells electricity works, was married to Elsie May Dean, of Maidstone, Kent, on April 15th, 1916, at Sutton.

General.—Referring to notes which have previously appeared in this column, Mr. CHARLES H. BEST, of Bradford, writes:—My attention has been called to a paragraph in your issue of April 7th, which refers to the relations between Mr. Charles Pullan and myself. I do not for one moment suppose that these relations are a matter of serious interest to your readers, still I cannot allow Mr. Pullan's statement to pass unchallenged. My connection with Mr. Pullan came definitely and finally to an end on February 4th. He knows this perfectly well, and I cannot imagine what purpose he thinks is served by the publication of a statement to the contrary. It is a question of legal fact, and not a question of anybody's opinion. Mr. Pullan is still consulting engineer to one or two existing village supply schemes, which he and I have jointly carried through, but, in the case of all the new schemes in which I am interested, I am seeking the assistance of other consulting engineers. He has no interest whatever, in any of my work in connection with these new schemes since February 4th. I shall be very much obliged if you will kindly give the same prominence to this letter as you did to that of Mr. Pullan.

Mr. T. M. CAREY, until recently electrical engineer at the Golden Horseshoe Mine, Boulder, W.A., has been appointed electrical engineer to the Perth (W.A.) City Council. Mr. C. A. UNBEHAUN, electrical engineer, G.P.O., Adelaide, South Australia, has retired after 39 years' service.—*Commonwealth Engineer.*

Roll of Honour.—Sergeant JAMES MAGUIRE, of the Manchester Regiment, formerly employed in the Manchester tramways department, who was recently awarded the D.C.M., has been killed.

Private JOHN WILCOCK, of the King's (Liverpool) Regiment, who was formerly employed at the works of the Chloride Electrical Storage Works, Clifton Junction, has been killed.

The Distinguished Conduct Medal has been awarded to Lance-Corporal W. A. GOODE, Royal Engineers, who was formerly in the switch shop of Siemens Bros. Dynamo Works, Stafford. He joined in September, 1914, and gained the D.C.M. for voluntarily repairing, under heavy fire, telephonic lines of communication.

Private ALBERT HILL, of the King's (Liverpool) Regiment, who has died from wounds, was formerly employed at the British Westinghouse Works, Trafford Park.

Private L. BROWN, of the Manchester Regiment, who has been killed in action, was formerly employed in the Manchester electricity department, at the Dickinson Street station.

The Military Cross has been awarded to Lieutenant A. C. SPARKS, R.E., A.M.I.E.E., "for conspicuous gallantry and initiative when taking part with some infantry in a raid on the enemy's trenches. With a small R.E. party he made a very successful reconnaisance of the enemy's trenches, and then exploded charges in two concrete structures."

The following have been mentioned in dispatches (according to the last issue of the I.E.E. *Journal*):—

Major A. S. ANGWIN, A.M.I.E.E., Lowland Signal Service, R.E.

Captain H. CAREY-THOMAS, A.M.I.E.E., London Army Troops, R.E.

Major L. EVANS, A.M.I.E.E., R.E.

Lieutenant R. K. MORCOM, M.I.E.E., Divisional Engineers, R.N.D.

CITY NOTES.

Marconi Wireless Telegraph Co. of America.—The report for 1915 states that before allowing for reserve, the net income was $288,994, as compared with $271,888 in 1914. Income from investments amounted to £104,932, and, after setting aside reserves, the net profit was $177,316, an increase of 18.3 per cent. on 1914. This has been added to the surplus, bringing it up to $541,887 at December 31st last. The reserve at the same date amounted to $373,415. Nearly 500 ships are fitted with Marconi apparatus managed by the company; a contract for standard installations on 36 large power barges for the Mississippi River has been secured, and since the beginning of 1916, 35 ships have been equipped. There has been no change in the commercial status of the trans-Atlantic stations, the high-power equipments remaining closed to business on account of the war. The British Admiralty still holds for Imperial Government use the English plants constructed to operate with the company's Belmar and New Brunswick duplex stations, and thus far, because of the war, it has been impossible to open similar direct service with Norway and Northern Europe through the newly completed high-power stations at Marion, Mass., and Chatham, Mass. Reliable and rapid service has been maintained between stations in California and Hawaii, and the volume of traffic shows steady improvement. The Hawaiian stations are known as two-way stations, being constructed so as to work with California and Japan simultaneously. The Japanese Government recently notified that its new wireless stations at Funabashi and Otchisi, near Tokyo, are complete and tests are now being made daily with a view to early inauguration of a public service, spanning 5,600 miles of the Pacific. Negotiations on traffic regulations are now in progress with the Japanese Government Department of Communications, and it is expected that by means of the Japanese Government cables the service will be extended to China, Manchuria, and other Far Eastern countries. The new circuit connecting the United States with Alaska was opened in August, 1915. All of the year's production of the factory at Aldene, New Jersey, has been rented, sold to patrons, or installed on steamships, in addition to which a number of sets have been manufactured on special order for the United States Government.

South Wales Electrical Power Distribution Co.—The report states that the business of the company shows a material increase during the year, the units sold amounting to 28,967,656, as compared with 26,510,198 sold in 1914. After payment of all working expenses and interest on prior lien debenture stock, and making provision for depreciation of new plant, the surplus amounts to £6,756, as compared with £5,347 in 1914. The indebtedness of £13,500 to certain members of the Treforest Co. for extra charges having, as stated in the last report, been provided for, this surplus has enabled payment to be made of the interest on the old debenture stock for the half-year to December 31st last—£5,000—leaving £1,756 to be carried to suspense account, and making, with the balance to the credit of this account at the end of 1914, a total of £3,999.—*Financier.*

Great Northern Telegraph Co., Ltd.—At the general meeting, which will be held at Copenhagen on May 6th, the board will propose to pay a total dividend and bonus of 22 per cent. for the year 1915, including the 5 per cent. already paid, and to transfer to the reserve and renewal fund (reduced by £233,202 on account of depreciation of securities) and to the pension fund the following amounts, namely, £138,889 and £22,222 respectively. It is, further, proposed to transfer an amount of £27,778 to the renewal fund for cable steamers, and to set aside £83,333 for extraordinary income taxes.

Dawlish Electric Light and Power Co., Ltd.—The war considerably affected the undertaking during 1915, but though there was a standstill in consumers and in revenue for current supplied, and a great increase in cost of coal and stores, the gross profit was very little less than in 1914. £200 has been put to depreciation fund for investment in 5 per cent. Exchequer Bonds. The net revenue balance applicable for dividend was £205, and, after paying a dividend of 1¼ per cent., free of income-tax, on the ordinary shares, £121 is carried forward.

Reading Electric Supply Co., Ltd.—The accounts for 1915 show that, after providing for interest charges and setting aside £3,500 for depreciation, a credit balance of £1,262 brought in was reduced to £453.—*Financial News.*

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended March 31st, 1916, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax.

Vickers, Ltd.—Final dividend of 1s. 6d. per share, or 7½ per cent., free of income-tax, making 12½ per cent. for the year.

Telephone Co. of Egypt, Ltd.—Including £164,276 brought in, the accounts for 1915 show a profit of £232,143. A further dividend of 6 per cent. is recommended on preferred and deferred shares, making the usual 10 per cent. for year, carrying forward £193,469.

La Plata Electric Tramways, Ltd.—The accounts for 1915, including £6,614 brought in, and after providing for debenture stock and other interest, show a credit balance of £12,142, which is to be carried forward.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of 1 per cent. on the issued ordinary capital stock, is announced.

STOCKS AND SHARES.

SATURDAY AFTERNOON.

As usual at the Easter season of the year, publishers' exigences render it necessary to write well in advance of the usual day of the week. The only reason for drawing attention to the sub-heading of this column is that quotations may have altered before the middle part of next week, and therefore it is advisable to point out that these notes are being written on Saturday afternoon.

Dramatic rises have occurred in the shares of the telegraph companies. This is due to the fact that the two Eastern undertakings and the Western Telegraph have all increased their dividends from 7 per cent. to 8 per cent. for the year, a surprise that was as pleasant as it was unexpected. The effect has been to stiffen quotations for other telegraph issues; and the difficulty is to get hold of any stocks in this market.

The position as a whole in the Stock Exchange is decidedly good; and although business fell away to some extent as the Easter Holidays approached, there is still sufficient to keep a fair proportion of its members profitably occupied. A steady rise in the price of the War Loan created a good impression upon all the investment markets. Practically every section dealing with industrials is in a thoroughly healthy condition as regards prices, and some of them are remarkably busy. The feature amongst Home Rails is a recovery in Metropolitans and a further rise in Underground income bonds.

Metropolitans spurted to 25½, being a rise of ¾ on the top of their previous advance of 1¼. At the present price, the yield on the basis of last year's dividend of 1 per cent. is under 4 per cent. on the money, so obviously there must be some further reason than yield to be sought for the rise. This reason has not yet become apparent, although there are various rumours current to account for it. Underground Electric incomes have again improved, this time to a small extent. In Districts there is not much doing, and some of the buyers who got in just before the three-points rise are evidently not unwilling to take their profit.

The three telegraph companies alluded to above have all declared dividends of 8 per cent., against their previous 7 per cent. This is the first time that the Eastern has made a change for 18 years, and the Eastern Extension for 27 years; while the Western has paid 7 per cent. for the past quarter of a century. The immediate effect upon prices was to send them up with a leap, and to render stock almost unpurchaseable. We know of one case in which a buyer was lucky enough to get stock at 137, which he sold, within an hour 4 points higher up. The companies are to be cordially congratulated upon their achievements; and the intensely conservative character of the boards is ample guarantee that the change would not have been made unless the directors felt entirely convinced that the increased distributions could be maintained.

Other telegraphs are better in sympathy. Great Northerns and Indo-Europeans are both somewhat nominal, inasmuch as the offer of shares is wanted and there is no supply. Globes rose to 11. The American group is not affected. Marconi shares eased off to 2 3/16 sellers on the appearance of the report of the American company, which is not as good as some people had hoped it would be, having regard to the recent buying of the shares from the United States.

The manufacturing shares of the telegraph group have not yet sympathised with the rise in the cable companies' issues, but it is taken for granted that they are pretty sure to do so. Iron and Steel concerns, and those connected with chemical companies—*e.g.*, Castner-Kellner—are showing marked strength, with demand eager not only from the provinces, but from London, too. British Westinghouse preference are conspicuously good, securing a gain of 1/16 on top of the deduction of 3s. dividend.

The electrical supply shares are steady, without exhibiting any particular alteration. Indeed, this section of the industrial market is still almost the quietest of them all. There is, of course, nothing to attract popular attention just now; while the advent of summer affords an additional reason to those already familiar for the market quietude. Nevertheless, the good yields obtainable from the principal shares are not lost upon investors with sufficient patience to investigate their proposed purchases in advance. South Metropolitan ordinary are better at 14s., but no shares have changed hands for the last two months.

Most of the Mexican stocks and shares have given way, upon what looks like a joining of forces between Villa and Carranza, in opposition to the United States. This novel turn of the kaleidoscope seems to have disturbed the Americans rather badly, although it was not wholly unlooked for by London observers of the situation.

The report of the Mexican Northern Power Co. throws interesting light upon conditions in the country. Between last October and December the Villa currency had no purchase value whatever. During this period the company continued to issue Villa money up to 25 per cent. of the pay roll, but redeemed all money so paid out by various temporary devices, the principal of which was the establishment of a butcher's shop. So ingeniously were payments of wages arranged that the result, says the report, was that "the labour cost per unit of work done was only about one-half of that which it had been in normal times." Brazil Tractions are a little easier at 54, and the Argentine department is inclined to be heavy.

The most active part of the Stock Exchange is the rubber market, where, notwithstanding a fall in the price of the raw stuff, an extraordinary amount of buying continues day by day. For this the issue of the spring reports is mainly responsible, because they show that the leading companies, and many of the younger producers, are earning extremely handsome profits, while the big dividends now being declared are likely to be exceeded by those to be paid in respect of the current year.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price April 12, 1916.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	10	6⅜	—	£7 8 2
Charing Cross Ordinary	5	5	3½	—	7 13 10
do. do. do. 4½ Pref.	4½	4½	3½	—	6 18 6
Chelsea	5	4	2½	—	6 8 1
City of London	9	8	11⅛	—	6 14 9
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10½	—	6 16 7
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	9	7	5	—	7 0 0
London Electric	4	3	1	—	9 0 0
do. do. 6 per cent. Pref.	6	6	4½	—	7 5 5
Metropolitan	3½	3	2⅝	—	6 4
do. 4½ per cent. Pref.	4½	4½	3	—	7 10 0
St. James' and Pall Mall	10	8	5½	—	6 16 2
South London	5	5	2½	—	8 18 10
South Metropolitan Pref.	7	7	1⅞	—	6 14 0
Westminster Ordinary	9	7	5½	—	6 1 9
TELEGRAPHS AND TELEPHONES.					
	Dividend, 1914.				
Anglo-Am. Tel. Pref.	6		93½	—	6 1 10
do. Def.	33/6		21⅛	—	7 19 3
Chile Telephone	8		6⅝	—	6 5 6
Cuba Sub. Ord.	5		7½	—	6 9 0
Eastern Extension	7		14	+ ⅜	*5 11 4
Eastern Tel. Ord.	7		140	+ 9	*5 14 4
Globe Tel. and T. Ord.	6		11	+ ½	*5 9 1
do. Pref.	6		10	—	6 0 0
Great Northern Tel.	22		86	+ ½	6 2 3
Indo-European	13		52	+2	5 5 0
Marconi	5		2 3/16	— 1/16	4 11 4
New York Tel. 4½	4½		100⅝	—	4 9 4
Oriental Telephone Ord.	10		17	—	5 6 8
United R. Plate Tel.	8		6	—	*6 13 4
West India and Pan.	1		1 1/16	—	9 10 6
Western Telegraph	7		14	+ ½	*5 14 4
HOME RAILS.					
Central London, Ord. Assented	4		67½	—	5 8 6
Metropolitan	1¼		25½	+ ¼	3 19 2
do. District	Nil		19½	— ½	Nil
Underground Electric Ordinary	Nil		1⅜	— ⅛	Nil
do. do. "A"	Nil		6/-	+6d.	Nil
do. do. Income	6		87	+ ½	*6 18 0
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6		47	—	£6 3 1
Anglo-Arg. Trams, First Pref.	5½		3⅝	—	7 6 8
do. 2nd Pref.	5½		3⅜	—	8 3 0
do. 5 Deb.	5		78	—	6 8 2
Brazil Tractions	4		54	— ½	6 9 8
Bombay Electric Pref.	6		10½	—	5 17 3
British Columbia Elec. Ry. Pfce.	5		58	—	9 8 8
do. do. Preferred	—		37	—	Nil
do. do. Deferred	—		33	—	Nil
do. do. Deb.	4½		62 xd	—	6 17 1
Mexico Trams 5 per cent. Bonds	—		40	— 1	Nil
do. 6 per cent. Bonds	—		52	— 3	Nil
Mexican Light Common	Nil		20	—	Nil
do. Pref.	Nil		39	—	Nil
do. 1st Bonds	—		39	— 2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14		22	—	£5 1 8
British Aluminium Ord.	5		22/- xd	—	6 7 3
British Insulated Ord.	15		10½	—	7 2 10
British Westinghouse Pref.	7½		2½ xd	+ 5/32	7 1 2
Callenders	15		11½	—	6 10 5
do. 5 Pref.	5		4⅝	—	5 17 8
Castner-Kellner	20		2⅜	—	6 8 0
Edison & Swan, £8 paid	Nil		7/-	—	Nil
do. do. fully paid	Nil		1½	—	Nil
do. do. 5 per cent. Deb.	5		57 xd	—	£8 15 8
Electric Construction	6		15/6	—	7 14 1
Gen. Elec. Pref.	6		9½	—	6 6
Henley	20		15	—	*6 13
do. 4½ Pref.	4½		4	—	5 12 6
India-Rubber	10		9½	—	*10 10 6
Telegraph Con.	20		35½	—	*6 13 4

* Dividends paid free of income-tax.

ELECTRICITY IN MINES.

The Report of the Chief Inspector of Mines (Sir R. A. S. Redmayne) for the year 1914, Part II, deals with the Report of the electrical inspectors.

It appears that on the outbreak of war Mr. Nelson, who was the Electrical Inspector of Mines, took up military duties, and his work was taken over by two junior inspectors, Messrs. W. E. T. Hartley and W. J. Charlton, the former taking Scotland and the Northern divisions, and the latter the four other divisions.

The following table shows the aggregate horse-power of electric motors in use above and below ground for the various divisions :—

Division.	Surface. H.P.	Underground. H.P.	Total. H.P.
Scotland	30,183½	106,972½	137,155 1/1
Northern	78,936¼	90,875¼	169,811½
York and North Midland ...	65,857 1/10	57,790⅝	123,648 3/10
Lancashire, North Wales and Ireland	13,117¾	22,502¼	35,620
South Wales	93,832½	100,443½	194,276
Midland and Southern ...	12,164½	41,105⅝	53,270 1/10
Total	294,092 9/10	419,689 7/10	713,782⅛

The following table shows the increase in 1914 over the figures for 1913, which is very satisfactory, and shows that electricity is steadily making headway in mines :—

	1913. Horse-power.	1913. Per cent. increase on preceding year.	1914. Horse-power.	1914. Per cent. increase on preceding year.
Surface	256,675¼	32·24	294,092	14·58
Underground ...	371,421¾	17·29	419,689	13·00
Total	628,097¼	22·97	713,782	13·64

The number of electrically-driven coal-cutting machines in use at the end of 1914 was 1,415, an increase of 108 over the number in use at the end of 1913.

During the year 1914 there were in all nine fatal accidents, definitely due to electricity, investigated by H.M. Inspectors of Mines, causing nine deaths.

Of the nine electric-shock accidents above referred to, five took place on the surface and four below ground. The figure for electric-shock accidents below ground, which last year had begun to show an upward tendency, has decreased considerably as will be seen below :—

Number of persons killed by electric shock below ground in coal mines—1907, 10 ; 1908, 12 ; 1909, 13 ; 1910, 15 ; 1911, 9 ; 1912, 7 ; 1913 and 1914, 4.

The figure for 1914 by comparison with 1913 is very satisfactory considering that the horse-power of electric plant in use below ground increased by 13 per cent. during the year. We have previously given details of these accidents.

In regard to machine mining, the following table gives the number of machines in use and the quantity of mineral obtained by their use.

Division.	Number of collieries where machines are at work.	Number of Machines.	Worked by Electricity.	Worked by Compressed air.	Mineral obtained. Tons.	Number of face conveyors at work.
Scotland...	230	913	747	166	9,195 645	128
Northern	92	702	156	546	3,571,312	68
York and North Midland	117	725	350	375	7,134,131	116
Lancashire, North Wales and Ireland	95	399	34	365	2,089 57	27
South Wales	58	131	44	87	634,821	63
Midland and Southern..	60	223	84	139	1,647,02[illegible]	6
Total in 19.4	652	3,093	1,415	1,678	24,274,51[illegible]	408
Total in preceding yea[illegible]	676	2,897	1,307	1 590	24,609,958	377

The following table shows the number of mechanical coal-cutters in use in the various Inspection Divisions :—

Kind of machine.	Number in use. Scotland.	Northern.	York and North Midland.	Lancashire, North Wales and Ireland.	South Wales.	Midland and Southern.	Total.
Driven by electricity :							
Disk	515	58	157	7	3	35	775
Bar	216	33	87	19	38	20	413
Chain	12	63	104	8	3	29	219
Percussive	2	2	—	—	—	—	4
Rotary heading ...	2	—	2	—	—	—	4
Total	747	156	350	34	44	84	1,415
Driven by compressed air :							
Disk	119	61	175	117	1	14	487
Bar	7	15	60	34	50	6	172
Chain	—	8	35	5	7	20	75
*Percussive	40	451	99	209	29	94	922
Rotary heading ...	—	11	6	—	—	5	22
Total	166	546	375	365	87	139	1,678
Total in 1914	913	702	725	399	131	223	3 093
Total in preceding year	876	665	673	393	115	175	2,897

* As these machines cannot be driven by electricity, the table really shows that out of 1,678, 922 *must* be driven by compressed air, whilst the remainder, 756, *might* be electrically driven.

In regard to shot-firing, it is interesting to note the usefulness of electricity in this dangerous undertaking. The following table shows the amount of explosive used and the number of shots fired by electricity, fuse, and squibs, from which it will be seen nearly half the total were fired by electricity.

Division.	Quantity of explosives used. lb.	Estimated number of shots fired. By electricity.	By fuse.	By squibs.	Total.
Scotland	7,170,725	1,741,643	8,498,409	643,971	10,884,023
Northern... ...	9,051,904	7,012,173	1,094,354	8,538,275	16,644,784
York and North Midland ...	1,894,810	3,606,076	504,681	900	4,111,657
Lancashire, North Wales and Ireland	1,948,654	4 930,902	242,390	—	5,173,292
South Wales ...	2,401,728	2,918 872	985,759	269,475	4,174,106
Midland and Southern ...	3,053 277	2.624,364	2,167,89	309,525	5,101,784
Total in 1914 ...	25,521.098	22,834,030	13,493,488	9,762,128	46,089,646
Total in preceding year	26,335,195	23,179,841	14,608,727	11,045,720	48,834,286

The use of electric safety lamps is also extending, as is shown in the following table :—

Division.	Total number in use.	Method of locking. Lead rivet.	Magnetic	Screw.	Other.
Scotland	3,365	290	3 047	4	24
Northern	6,987	4,510	2,469	—	8
York and North Midland	38,035	5,516	32,443	—	76
Lancashire, North Wales and Ireland	2.398	1,532	851	—	15
South Wales	23,066	1,195	21,866	—	5
Midland and Southern ...	1,856	744	1,096	—	16
Total in 1914	75 707	13 787	61,772	4	144
Total in preceding year...	37,823	14,604	22,756	249	214

The figures show that nearly 40,000 electric lamps replaced a similar number of oil lamps. The total number of oil lamps in use during the year 1913 was 740,001, which was reduced to 679,572 in 1914.

THE EFFICIENCY OF LABOUR.

By E. E. HOADLEY, M.I.E.E.

An oft-quoted definition of an engineer is "A man who can do for eighteenpence that which any fool can do for half-a-crown"; in other words, an engineer is a man whose duty it is to make the most out of anything and to use material and labour to the greatest advantage.

In the domain of Central Station Engineering (to which the writer only intends the present article to apply), it has been his impression, gathered from a large number of central stations that he has visited, that in some of them, at any rate, greater efforts are made towards economy in material than towards economy in labour. The word economy is here used in its best sense and has no connection with parsimony.

At times such as the present, when conditions in the labour market are about as bad as they possibly can be, and when mighty happenings in the relations between capital and labour are being conceived in the brains of the leaders of labour, it behoves everyone who is in a position to do so, to help in however small a way in drawing employers and employed more closely together and convincing them that after all, and in the widest sense, their apparently divergent interests are in the main identical.

The writer wishes to make it quite clear that this article is intended to be absolutely non-political and non-socialistic, and that he is merely putting on paper his convictions, the result of many years' experience, as they apply to electricity supply.

In any manufacturing works, economy in the cost of output depends to a certain extent, either greater or less, on the way in which the workers perform their allotted jobs.

It may be urged that an electricity generating station is not a manufacturing works, in the usual acceptance of the definition, but I think it will be agreed that the conditions are sufficiently alike for the goodness or badness of the labour employed to have a very decided effect on the financial results.

The methods and means by which labour in an electricity works can be employed most profitably are management and supervision—management being the brains that so apportion and arrange the work that each man is working efficiently; supervision, seeing that those arrangements are being carried out. But, in spite of good management and good supervision, the best results cannot be obtained unless the men themselves have their hearts in the work and are made to realise by some means or other that in doing their best for their employer they are also doing the best for themselves.

For many years past bonus schemes or profit-sharing schemes have been in operation in electricity supply stations, but until quite recently conditions have not been stable enough to enable a satisfactory scheme to be got out which should at the same time be simple, equitable, and easily understood by the men.

The writer has evolved several schemes of this nature, and one or two have been put into operation, with more or less satisfactory results, but owing to various causes they have all died a natural death.

It is much easier in a company-owned concern to draw up a scheme which shall be to the advantage both of the men and of the company, than it is in a municipally-owned undertaking; the reason being that in a company-owned supply the primary object is admittedly the making of profits in order to pay dividends to the shareholders, which at once gives the basis of a satisfactory scheme. In a municipally-owned undertaking, the first aim of those responsible is, or should be, to give a supply at the lowest possible price consistent with keeping the undertaking in a sound financial condition, and not the making of large profits. This complicates any system of co-partnership based on profits.

The author has tried a system based on cost per unit sold, but here again the constant alteration in conditions, brought about by the installation of more economical plant, finally brought the scheme to an end.

After carefully reviewing the various schemes which have been and are in operation in municipally owned undertakings, and after giving much thought to the problem, the writer is strongly of opinion that a scheme of this nature makes for the best interests of the undertaking and of the men themselves.

The next question is—How shall it be worked out and on what shall it be based? Here again, after much argument and weighing the pros and cons of the various bases for a scheme, the author considers that at the present time most supply stations are proceeding along more or less regular lines, and it is possible to estimate with fair accuracy the revenue and costs for twelve months' ahead. It is, or should be, possible so to arrange the charges for the supply as to ensure the total costs being covered and a margin of a predetermined amount left over and above these, this margin being net profit.

With these premises it is not difficult to draw up a scheme, having as its base profit-making, giving to the staff a certain precentage of the profits and increasing the percentage on all profit made over and above the estimated amount.

The method of dividing up the bonus due to the staff has had a good deal of consideration, and in the end the author considers the simplest and fairest method is to divide up the total amount in the proportion of the total annual earnings of each man as wages.

The writer is about to put a scheme drawn up on the above lines into operation in the station of which he has control, and it will be interesting to see how far his hopes and ideals are borne out in actual practice.

There is, in addition to the general bonus scheme outlined above, another special bonus scheme on which the writer sets great store, and which he has had in operation for some years with much success. This is a bonus payment to the stokers, based either on the lb. of coal burnt per unit generated or on the lb. of water evaporated per lb. of coal burnt. The details of such a scheme are easily worked out for the local conditions pertaining to each station, but in the writer's case 10 per cent. of the saving in fuel costs below a certain fixed figure is divided among the stokers. The figures for each quarter are fixed beforehand and posted in the boiler house.

This coal bonus to the stokers should be worked in addition to the stokers participating in the general bonus scheme, as in all but the largest stations the work of the stokers has a large influence on the costs.

The above schemes are, in the opinion of the writer, well worthy of consideration; that they are open to improvement is beyond doubt, but time and future circumstances will enable these improvements to be made. In the main, however, any arrangement such as the above must do a certain amount of good, as it convinces the men that they are working for the best of all masters—themselves; in so doing they realise that any saving they can make is for their benefit as well as that of their employers, and the general body of the men will not tolerate for long a man who is a slacker and not doing his best.

In settling the amounts to be paid as bonus to the men, the writer considers that the amount it is possible for each individual to earn should be substantial, and enough to make the man try his best, yet it should not be sufficiently large to be looked on by the man in the same light as wages.

In conclusion, the author would express his thanks to Mr. Bowden, of Poplar, Mr. Hall, of Burton-on-Trent, and Mr. Seabrook, of Marylebone, for help and suggestions received.

SWITCH CONTROL FOR AUTOMOBILES.

(Communicated.)

The great popularity at present enjoyed by automobile electric lighting and starting sets is to be traced in no small degree to the ease of control available, a simplicity of arrangement, however, which has unfortunately resulted in a lack of investigation on the part of designers and others most closely concerned. The advantages and conveniences of electric light may be enormously increased by an intelligent appreciation of switch control, for this is a matter which, in the hands of a few, has undergone even more wonderful changes than the design of the electrical fixtures themselves.

The correct disposition of the light units and the advantages of an electrical supply are but two of the points to consider when an electrical installation has been decided upon.

The third, and equally important point, is the switching arrangement adopted. Given a clear grasp of the latter, then, and only then, can the manifold advantages of an electrical supply be fully appreciated.

The matter is one which is closely allied with that of the furtherance of the motor industry in this country.

The American sets are nearly all standardised, and, having decided upon a particular method of control, the same is incorporated as a fixed unit of a standard machine. In our country it is almost safe to say that the choice of the electrical equipment and control thereof is left to the individual taste and requirement of the customer. The result is lack of standardisation and a corresponding increase in the cost of the set provided.

There should be a standardised method of control adopted for each particular case requiring consideration. The necessary switch-gear is available, and by a closer co-operation between the various interested parties a step in the direction of standardisation of electric sets for car purposes would be taken.

In the following notes some brief control outlines are indicated, and while not claiming originality for the same, the author is of the opinion that consideration and criticism may lead to a more intelligent appreciation of the advantage and ease of electrical control taking place.

Improved Controls Available.—The interior lighting of cars is usually left in the hands of the occupants. Improvement is possible by arranging a dual control, a two-way circuit, with one switch inside and the other outside near the driver, enabling the latter to switch on when the car is about to be occupied, or to switch off if the late occupants should have forgotten to do so.

It is possible also to arrange for the control of electric heaters in much the same way. A heater should be controlled by a pilot switch and a pilot lamp fitted in a conspicuous place, independent control being given to the driver if a two-way circuit is used with the pilot lamp.

Automatic step or foot-board lighting is easily arranged for by the insertion of a spring-on switch let into the door jamb, and the convenience of this form of control should lead to its universal adoption for all enclosed cars, at least.

The usual method of signalling to the driver is open to objection, and frequently it is impossible in traffic to make oneself heard from the inside of the car. Silent communication by means of coloured lights is, however, a perfectly sure and safe method at all times of the day or night.

All that is required is two small dash lamps and a switch inside the car. The "Twinob" switch, to quote one example, arranges for the operation in the following way: Right-hand lamp on—Turn right. Left-hand lamp on—Turn left. Both lamps on when running—Stop. Both lamps on when standing—Start.

In this way all communication dangers, which are always present, especially in traffic, are avoided, and a simple standardised method of control is adopted.

The elimination of unnecessary switches and the corresponding simplification of the wiring are points that should appeal to all who are interested in the furtherance of the motor-car industry.

In many cases a single switch may be made to perform numerous operations, such as putting both head and side lamps in parallel or series for full or dim running, while at the same time providing a control for the tail light.

Other combinations can quite easily be arranged, as it is merely a matter of stating the requirement and then choosing the switch capable of performing the necessary operation.

The whole point is that the improved controls are available, and that far from being in any way mysterious they are the simplest pieces of mechanism, and are merely the results of pushing electrical considerations to a logical conclusion.

What is needed is co-operation between those interested in the sale and utilisation of electric sets and those manufacturers who have studied the means of utilising the current to the best advantage. In this way quite unnecessary cost and complication can be eliminated. The system can be reduced to the simplest one possible, satisfying the necessary requirements, and a standardised method of control arrived at. Intelligent co-operation is the secret of the whole matter.

REVIEWS.

Wireless Telegraphy. By Dr. J. Zenneck. Translated from the German by A. E. Seelig, E.E. London: Hill Publishing Co. Price 17s.

This book is not, as the author is careful to explain in the preface, merely an abridged edition of his original German publication. In adapting it to keep pace with the progress of the subject it has become essentially a new work.

As one of the foremost German authorities on the theory, if not also the practice, of wireless telegraphy, the book possesses great interest as a disclosure of the theory and practice as it is viewed in Germany at the present time. In the first chapter on condenser oscillations there is evidence of thoroughness and clear grasp of principles in many directions which make the usual slip-shod text-book explanations appear feeble. As an instance, in referring to the energy losses in the spark gap, the author is careful to term the effect concerned "gap decrement" and to explain the precise factors involved in this quantity rather than to talk in a loose and misleading way of the resistance of the spark gap, as though it were a fixed and definite, instead of a highly variable, quantity. The degree of ionisation of the spark gap, and, therefore, its conductivity, necessarily varies with the current passing at any instant; the resistance therefore suffers a large cyclic change in each half-period of the oscillations, and a full appreciation of the magnitude of this change and the various factors controlling it is necessary to a proper understanding of spark gap effects, especially quenched spark gaps.

A useful part of the second chapter is that dealing with the theory of series capacity and inductance inserted in linear oscillators or antennæ. In developing the explanation of these cases the author does not appear to have expanded the treatment to cover the effect in receiving. This is important in view of a proper perspective being obtained with regard to the selectivity of such antennæ, and in view of the fallacious methods of obtaining selectivity which hold at the present day in this country and elsewhere. Reading between the lines, the author is probably quite alive to the weakness of the premises on which many methods in practice are based, but he refrains from any direct criticism of them.

In a very clear exposition of the effects of resistance, capacity, and self-induction in high-frequency circuits some room is left for a fuller explanation of the many elusive effects

of self-capacity of coils, especially where idle windings of many turns are concerned. The chapters devoted to the discussion of coupled circuits and resonance curves are of a highly informative character, and deal largely with investigation and measuring work. Useful practical hints as to means of obtaining accuracy and checking results of tests are given; thus the means of eliminating errors due to eddy currents occurring in the coatings or plates of condensers forming part of an oscillatory circuit are explained. In this connection, however, the student might very usefully have his attention drawn to a source of error which is often very serious in large transmitters, namely, losses due to the degree of proximity of the ground, walls of building, his own body, or any material substance which is neither a perfect conductor nor a perfect insulator, and which is within reach of the oscillating electro-magnetic field. Mention is made of an interesting method of completely suppressing one of the wave components of a coupled transmitter giving a double wave, the suppression occurring so far as the measuring instrument is concerned. The author is no doubt alive to the bearing of this method in other directions which he does not specify. In a chapter devoted to the antenna, the author gives special consideration to the important question of grounding and its equivalent, as in the counterpoise method. In his analysis he appears to have overlooked at least one very important consideration, to which it may be as well not to refer specifically in present circumstances, though the omission may be intentional.

Much of the interest that will be felt in this work will no doubt turn upon the comparisons between quenched spark and unquenched spark systems, the former representing standard practice in Germany. In appraising the quenched spark method, both with the Wien type spark gap and the mechanically-quenched gap which Marconi claims to be using in high-power stations, sufficient attention is not paid to the impure character of the wave emitted during the period prior to quenching, representing considerable energy waste. It is necessary to have regard to the fact that the antenna oscillations have grown to their maximum amplitude when the primary spark is quenched, and that the radiation taking place during this period is practically wasted. Probably the really effective radiation only commences after the primary circuit is quenched. As a general proposition, in spark systems a wave train is impure to just the extent that decrement or increment exists in the train. An absolutely pure wave is, therefore, unattainable; but the nearer the amplitude reaches uniformity the purer and more efficient the radiation. It is, therefore, just a question whether it is better to make the wave increment very large and the subsequent decrement small, as in quenched spark methods, or to keep both the increment and the decrement small, as in lightly-coupled unquenched systems. This cannot be fully elucidated theoretically, as practical limitations are concerned.

In the theory of wave propagation much prominence is given to the so-called surface wave theory of Sommerfeld. Essentially, however, this theory is merely an elaboration of a very early theory first published in the Electrical Review in A.D. 1900. As rendered by Sommerfeld, it is rather in the nature of an artifice to resolve wave propagation into two parts which can have no separate existence, but which resolution renders the propagation more amenable to analytical treatment. One part is treated as a wave following the contour of the earth's surface, and the other as a free space wave. It is not clear that this point of view results in any very marked elucidation of most of the observed facts of long-distance transmission. A point of criticism in reference to this part of the work is that the student is apt to be led to overestimate largely the effect and importance of the conductivity of the ground at a large number of wave lengths' distance from the source of the waves. It is never explained to him that the resistance of the annulus of surface occupied by the base of an advancing wave becomes progressively less as the wave expands. Hence, the effect of the specific resistance of the soil may become practically negligible.

A separate chapter is devoted to detectors, from which much valuable information may be gleaned. By a somewhat remarkable oversight, the author appears to regard the simple rotating magnet form of magnetic detector as a practicable instrument. It is also rather surprising in a German book of this character to find no reference to the anti-coherers of Neugschwender and Bela Schafer, though that of de Forest is fully described. There are some questionable statements with regard to coherer methods and appliances. Here the author distinctly does not shine, for he is repeatedly caught depicting the Morse circuit tapped off through choking coils from the terminals of the coherer—a disastrous proceeding in practice. Marconi is given undue credit for the initiation of the receiving transformer as used with the coherer. For the development of it, such as it was, he is entitled to the credit, but he received the first suggestion from the British Post Office. The chapter on receiving-station arrangements contains one or two doubtful assertions, such as the statement that a high receiving aerial is at a disadvantage because it re-radiates the energy too quickly. Such a statement is distinctly open to challenge, at least in respect of the reason advanced. In the matter of resonance curves, the author follows the usual course of basing his conclusions as to the degree of selectivity attained between a pair of stations on the curves obtained by wave meter methods. If a method of tracing out the curves *at the receiving station* be used it will be found that, in the case of spark transmitters at least, the merging of wave lengths by the receiver so entirely swamps any ordinary differences in sharpness of resonance exhibited by the transmitter, from such causes as changes of coupling, that double wave emission is no longer traceable. This means that undue stress has hitherto been laid on the need for highly-tuned spark transmitters in order to avoid interference.

In the theoretical treatment of wave reception there is a rather remarkable and serious omission which calls for comment. The theory of arrest of waves by the receiving antenna and mode of extraction of wave energy from surrounding space, together with limitations concerned in the process (that is, the reverse of the actions which occur at the transmitting antenna), are not touched upon. Other omissions of a more excusable character are in respect of later developments of systems (German and other), developments of vacuum tube amplifiers and transmitters. Neither does the book contain precise information as to difficulties met and results given by long-distance communications, of which a considerable number have now been established for some time. Indeed, the degree of secrecy observed by all commercial undertakings in this matter carries with it a strong hint of disappointment.

In general, also, the perusal of the work gives the impression that whereas Prof. Zenneck is a reliable authority on transmitters and transmission effects, he is much less so with regard to receivers and receiving effects.

The book contains a vast amount of useful information, though many of the quantitative results of measurements are not yet ripe for full acceptance. They will bear much cross-check, by the application of entirely different methods, for their full confirmation.

Though some criticism has been made in the foregoing, there can be no doubt that neither engineers nor students can afford to ignore this work if they are to make the best use of available knowledge and improve British practice in many needful directions.

Useful tables, data, and a valuable bibliography of some 355 references to original papers and publications complete the work in a fitting manner. There is a number of minor slips or misprints in the letterpress, illustrations, and tables, many of which are, however, sufficiently obvious.—J. E. T.

The Telephone and Telephone Exchanges: Their Invention and Development. By J. E. Kingsbury. London: Longmans, Green & Co. Price 12s. 6d. net.

Twenty years ago Mr. Kingsbury said "it was quite impossible to deal with any question of early telephone history without quoting Mr. Lockwood." Henceforth, it may safely be said, no one dealing with telephone development generally can avoid reference to Mr. Kingsbury.

In the introductory chapter the earliest attempts at the transmission and amplification of sound are summarised, and we are led from the Otacousticon exhibited at the Royal Society in 1668 to the views of Sir Charles Wheatstone on the subject of molecular transmission of sound waves. There, however, the matter remained until the advent of the Bells, father and son, when electricity was called upon to aid in the transmission of speech; and in this connection it is interesting to read the letter of Graham Bell, written in 1875, to his parents, describing an interview he had had with Prof. Henry, in which he states that he frankly admitted to Henry that he did not possess the electrical knowledge necessary to overcome the difficulties which he saw before him, and got for answer the laconic reply, "Get it." The world little knows how much it probably owes to these two words, spoken at a time when Bell was living in an atmosphere of blank discouragement. To-day we read (Elec. Rev., January 7th, 1916): "Dr. A. Graham Bell conversed with his assistant of 1876, Mr. T. A. Watson, over 3,400 miles of line between New York and San Francisco"!

Nine chapters are devoted to the development of the telephone and its eventual employment for commercial purposes. Chapter IX deals with the inception of the telephone exchange, suggested in the first instance by Dumont, of Paris, who took out a British patent in 1851 for the interconnection of telegraph lines through a central office. In 1881 the first Post Office exchange in this country was opened at Swansea.

The evolution of the variable resistance transmitter and microphone is dealt with, and the work of Hughes, Edison, Blake, and Hunnings in this field is adequately summarised.

Passing over the sections on Philip Reis, call bells, switchboards, &c., we come to that which deals with the advent of the telephone in Europe, the commercial developments of which "were initiated by American patentees assisted by a few influential and far-seeing people in each country."

Pages 207-11 are of peculiar interest inasmuch as they depict the official attitude in this country towards the telephone in 1879. In that year Sir Wm. Preece—then Mr. W. H. Preece—giving evidence before a Select Committee in the House of Commons, in answer to Lord Lindsay's question, "Do you consider that the telephone will be an instrument of the future which will be largely adopted by the public?" answered "I do not." This was the view of the Electrician to the British Post Office, and though it is always safe to predict after the event, yet had Preece recognised the potentialities of the instrument, and had the Department purchased the Bell patent which was then offered it, how differently might not its policy have been affected in the years that were

to follow. But Preece's opinion appears to have been formed from a consideration of the inductive troubles to which the instrument was subject, and which at that time appeared insuperable, and remained so until Brooks, in 1881, patented the metallic circuit and solved the problem.

Chapters on multiple switchboards, line construction, the evolution of the dry core cable, and early exchange systems are followed by a chapter on telephone engineering on a scientific basis, in the course of which Mr. Kingsbury refers to the acute diversity of opinion which obtained in 1896 on the merits and demerits of the vertical and horizontal switchboards. We recall that in the discussion of Mr. Dane Sinclair's paper, the author and Mr. Preece were the two most prominent opponents of the flat board; but Mr. Kingsbury studiously avoids any reference to Mr. Preece's moral objection, or to Mr. Sinclair's effective rejoinder!

Fairly long chapters on branching systems and the common battery system lead up to the "Automatic," the treatment of which, on account of its brevity, will prove disappointing to many of our readers; but as Mr. Kingsbury says, "It has been preferred to give in greater detail particulars of the earlier work and to discuss the general principles involved in the later developments," and, in connection with the controversy still being waged on "Auto" *versus* "Manual," he adds, "results cannot be recorded for some time yet, and any definite forecast is to be deprecated."

An echo of another famous controversy is to be found on page 433, where we have retold the duel between Mr. Preece and Prof. Silvanus Thompson on the essential elements in long-distance transmission.

In pages 430-35 Preece's K.R. law and Heaviside's biting criticism of the same are brought under review. Pupin's practical application of loading coils to telephone circuits is discussed, and in this connection it is interesting to read (page 441) of the demonstration given by Sir W. Slingo to members of the technical Press last year, of the transmission of speech over a loaded underground cable 660 miles long. No cross-talk was observable from the other wires in the cable, and immunity from disturbance was absolute and complete.

An interesting chapter is devoted to the first Anglo-French telephone cable, designed by Mr. H. R. Kempe, late chief electrician to the Post Office, and is accompanied by a unique illustration of the late King Edward speaking his congratulatory message to the President of the French Republic. Our older readers will have no difficulty in identifying the various personalities forming his *entourage* on that memorable occasion.

The concluding chapters deal with instruments, rates, economics of the telephone, and the telephone and Governments.

Mr. Kingsbury is to be congratulated on the production of a book which, we do not doubt, will take the place in its own sphere that Sir Charles Bright's work occupies in submarine telegraphy.

A word of praise is also due to the publishers, Messrs. Longmans, Green & Co., on the general excellence of production which characterises the work throughout.—A. F.

Mechanical Technology. By Prof. G. F. Charnock, M.I.C.E. London: Constable & Co., Ltd. Price 7s. 6d. net.

There is an interesting flavour even about the title of Prof. Charnock's book. It seems to suggest, by analogy with chemical technology, a wide and comprehensive field full of all sorts of attractive possibilities. And that suggestion is found to be borne out when we come to investigate this 635-page treatise "on the materials and preparatory processes of the mechanical industries." The reader is not likely to be disappointed in the author's attempt to bring together in one volume "a connected and systematic account of the chief operations underlying mechanical trades and handicrafts." Of course, the book is not exhaustive, nor is it intended so to be; but it is quite sufficiently encyclopædic for the average work-a-day engineer who wants to know briefly and quickly the "why and wherefore" of his materials and processes.

A workmanlike plan is adopted by the author in the arrangement of his matter. Thus the chapters comprising Part I discuss "the production and properties of the chief materials of construction," a big field, admittedly, since it covers iron, steel (including electro-thermic steel), alloy steels, non-ferrous metals and alloys, timber, stone, leather, and rubber, to mention but a fraction of a list of the things with which engineers have to deal.

Next comes Part II, where "preparatory processes depending upon the property of fusibility" are detailed. Here we find described the foundry, methods of moulding, production of castings, defects in castings and their remedy, this section being followed by a final one (comprising Part III) devoted to "processes depending upon the properties of malleability and ductility." These processes include forging, stamping, rolling, tube drawing, and the manipulation of sheet metal. Last of all, the author gives us a bibliography which makes it possible to see what books to turn to if fuller information than that given by the author is required. Altogether, we can strongly recommend Prof. Charnock's volume to all but the most advanced workers; and it is to be questioned if even they would not have to admit that a perusal of the book, and of its numerous and excellent illustrations, had taught them many things that they did not previously know, so extensive is the ground covered by the author.—G. S. S.

IGNITION MAGNETOS.

In *La Revue Electrique* for March 3rd, Messrs. D. Nobili and G. Campos (engineers of the Italian "C.G.S. Co.") refer to the article of M. Armagnat, which was abstracted from the same journal in the Electrical Review of October 15th and 22nd, 1915, and describe some experiments which they have recently made to determine the energy output of magnetos.

It being necessary to avoid wattmeter methods, and generally every method based upon the use of circuits directly connecting the high-pressure terminals in any way whatever, the authors adopted a direct method of measurement of the energy of the spark, with the help of a calorimeter. The instrument employed for this purpose (fig. 1) had a bulb filled with nitrogen at atmospheric pressure, containing a spark-gap with platinum points and a spiral of resistance wire, the latter being connected to an independent circuit and serving to calibrate the instrument with direct current. To any given height of the mercury column there corresponded a definite expenditure of energy, derived either from the heating of the spiral wire or from the spark passing between the platinum points. The speed of operation or rotation of the magneto gave the number of sparks per second.

The conditions of working of a magneto in connection with the calorimeter are obviously different from those under which the ignition spark passes in the cylinder of an internal-combustion engine, where the discharge takes place in inflammable gas under pressure; it is possible, however, not only to compare the performances of different magnetos by this means, but also to obtain results in all probability not greatly differing from those which correspond to the actual conditions of operation, for it is evident that the amounts of energy stored up in the magnetic circuit are equal in both cases. In fact, tests made with widely differing lengths of spark have given results not greatly discordant.

Measurements carried out with four snap magnetos for aviation motors at various speeds gave the results shown in fig. 2; other tests, made on magnetos with rotating armatures, are shown in fig. 3. These curves indicate that, at any rate in the case of the types of magneto experimented on, the energy per spark remains practically constant from low to high speeds, or, in some cases attains a maximum at a particular speed.

The authors state, also, that the minimum and maximum values obtained for the energy of the sparks are included between the limits calculated by M. Armagnat for the energy available in the magneto; they are, however, far removed from his maximum

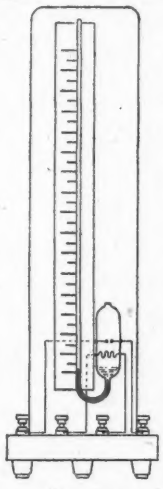


Fig. 1.

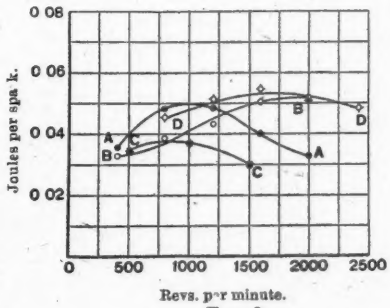


Fig. 2.

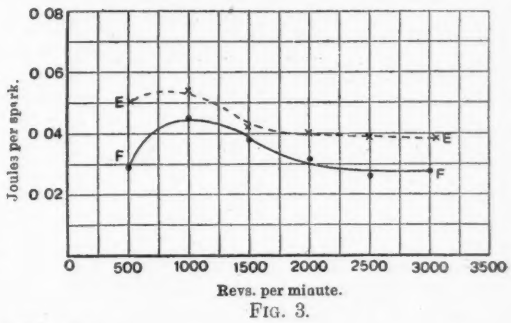


Fig. 3.

Experiments on Ignition Magnetos.

limit, showing that the apparatus has a low electrical efficiency. This is not a serious drawback, owing to the small quantity of energy that suffices for the ignition of even large engines; nor is it surprising, seeing that in the case of such a generator of electrical discharges, which are probably oscillatory, a large proportion of the energy is dispersed in the metallic masses.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

URUGUAY.—A Presidential Decree, dated January 25th, amends Articles 211-13 of the Consular Regulations, concerning the manifests of goods shipped to Uruguayan ports. Manifests must conform to the model annexed to the Decree, and must contain the following particulars:—

1. The class, flag, and name of the vessel, the name of the master, the ship's registered tonnage, the port of departure, and the Uruguayan ports for which bound;

2. The numbers of the bills of lading, the marks, numbers, quantities, kind and contents of the packages, the gross weight or measurement of the packages, and the net weight of each package;

3. The name of the shipper and of the person to whom the goods are consigned, or an indication that the bills of lading are "to order";

4. Country of origin of the goods (except for goods declared "in transit"); total value of the goods (if possible, expressed in Uruguayan gold pesos); freight rates (except in the case of goods declared "in transit"), and amount of freight paid.

Four copies of each manifest (instead of three, as previously) are to be presented to the Uruguayan Consular Agent, at least two of which must be drawn up in, or translated into, Spanish. Two copies of the manifest are to be "legalised" by the Consular agent.

In cases where Consular agents cannot obtain from shippers the particulars as to freight (see under 4 above), they are to calculate the figures at the rates current in their place of residence during the week in which the shipment is made.

Annexed to the Decree is a model of the certificate of origin which Uruguayan Consuls are empowered by the Decree of September 13th, 1915, to issue in respect of goods destined to be imported into Uruguay.

The provisions of the Decree came into force on April 1st, 1916; and the complete text of the Decree, and of the forms of manifests and certificates of origin annexed thereto, may be seen at the Commercial Intelligence Branch of the Board of Trade.

BRITISH INDIA.—*New Import Duties taking effect on March 1st.*—The general 5 per cent. tariff is raised to 7½ per cent. Certain classes of machinery and railway material, which were formerly free, are now subject to a duty of 2½ per cent., and motor lorries, formerly free, now pay 7½ per cent.

JAPAN.—A Government Bill has been introduced into the Diet proposing to modify the Customs duties on various articles imported, among which are the following. Proposed additions to the text of the Tariff are indicated by italics.

	Rate of duty. Present. Yen. Per 100 kin.	Proposed. Yen. Per 100 kin.
Brass and bronze bars and rods—		
(*a*) *For steam turbines*	7.55	16.00
(*b*) *Others*	7.55	7.55
Gas engines, petroleum engines, and hot-air engines—		
Other (each weighing more than 2,500 kilogs.)—		
Each weighing not more than 10,000 kilogs	5.00	5.00
Each weighing not more than 50,000 kilogs.	5.00	4.50
Each weighing not more than 100,000 kilogs.	5.00	4.00
Other	5.00	3.50
Dynamo-electric motors, transformers, converters, armatures, *and alternating current variable speed electric motors*	Rates unchanged.	
Dynamos combined with gas engines, petroleum engines or hot-air engines—		
Other (each weighing more than 5,000 kilogs.)—		
Each weighing not more than 10,000 kilogs.	5.80	5.80
Each weighing not more than 50,000 kilogs.	5.80	5.50
Each weighing not more than 100,000 kilogs.	5.80	5.20
Other	5.80	4.90

[Yen (100 sen) = 2s. 0½d.; 100 kin = 132.277 lb.]

GREECE.—In the issue of the Review of March 17th particulars were given of a Decree providing for the duty-free importation into Greece of certain tools, machinery, instruments, and utensils of agriculture and the branches of industry connected therewith, *when imported by Agricultural Associations*. A further Royal Decree has now been issued providing that *all* the articles in question are exempt, on importation into Greece from abroad, for a period of four years from January 1st/14th, 1916, from State import duty, and from harbour, communal, municipal, or other tax.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

4,837. "Electrical batteries." E. A. Bayles, F. J. Brisley and British Insulated & Helsby Cables, Ltd. April 3rd.
4,853. "Electric fuses." H. B. Prentice. April 3rd.
4,859. "Sparking plugs for internal-combustion engines." W. Taylor. April 3rd.
4,865. "Sparking plugs for internal-combustion engines." J. J. Creasby. April 3rd
4,901. "Electric heating devices." L. Heller. April 3rd. (Germany, July 16th, 1914.)
4,938. "Electric time switches." A. M. Coates. April 4th.
4,940. "Spur gearing." British Thomson-Houston Co. (General Electric Co., U.S.A.). April 4th.
4,942. "Automatic or semi-automatic telephone exchange systems." L. C. Bygrave & Relay Automatic Telephone Co. April 4th.
4,959. "Electrical means for producing musical notes." L. de Forest. April 4th. (U.S.A., April 24th, 1915.)
4,962. "Electrical driving, particularly for motor vehicles." H. Crochat. April 4th
4,981. "Electric diaphragm horns." W. R. Carter. April 5th.
5,009. "Magneto-electric machines." C. L. Breeden & J. H. Chambers. April 5th.
5,038. "Arc lamps." F. M. Lewis. April 6th.
5,053. "Portable electric torches, &c." W. A. Jacobs & P. Pollard. April 6th.
5,061. "Telephone instruments." E. A. Petithory. April 6th.
5,069. "Electrical hand lamps." S. Fildes. April 6th.
5,070. "Ships' telegraph, &c." A. Ferguson & Mechans, Ltd. April 6th.
5,085. "Magneto-electric machines." M. Collard & J. W. Miller. April 6th.
5,091. "Electrical circuit systems." E. C. R. Marks (American Model and Instrument Co.). April 6th.
5,092. "Electrically bonding rail-ends." J. C. Lincoln. April 6th.
5,163. "Electrically indicating presence of saline, alkaline, or acid impurities in feed-water for steam generators, &c." Bromell Patents Co. & W. C. Crockatt. April 8th.
5,171. "Electric fittings." J. Gray & J. Wilkie. April 8th.
5,175. "Holders for arc lamp carbons, &c." A. W. Bennis. April 8th.
5,194. "Accumulator cells, &c." C. C. Rattey. April 8th.

PUBLISHED SPECIFICATIONS.

1915.

2,697. Electric Maximum Cut-outs. G. J. Van Swaay & H. I. Keus. February 19th. (Convention date not granted.)
2,841. Systems of Electric Ship Propulsion. British Thomson-Houston Co. (General Electric Co., U.S.A.). February 22nd.
4,138. Electric Conductors, Cables, and the like. Herbert Terry & Sons, Ltd., and C. Terry. March 16th.
4,230. Winding Machines for Winding Electrical Coils. H. Wade (J. R. Leeson). March 17th.
4,285. Automatic Telephone Exchange Systems. C. A. W. Hultman. March 18th. (March 18th, 1914.)
4,483. Fusible Electric Cut-outs. F. B. Dehn (Schweitzer & Conrad). March 22nd.
4,595. Protection of Alternating-current Electric Systems. British Thomson-Houston Co. & E. B. Wedmore. March 24th.
4,664. Magneto-electric Machines. British Thomson-Houston Co. & A. P. Young. March 25th.
4,675. Mine and other Electric Signalling Systems. Sterling Telephone and Electric Co., Ltd., F. G. Bell & H. W. Barclay. March 25th.
4,738. Protection of Alternating-current Electric Systems. British Thomson-Houston Co & E. B. Wedmore. March 26th.
4,999. Electric Welding. W. M. Mordey. March 31st.
5,373. Methods of and Means for Amplifying Electric Potential Variations. British Thomson-Houston Co. (General Electric Co., U.S.A.). April 9th
5,853. High-speed Rotating Shafts and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.). April 19th.
6,407. Regulation of Dynamo-electric Machines. British Thomson-Houston Co. (General Electric Co., U.S.A.). March 29th.
6,708. Sparking Plugs. J. A. Kennedy-McGregor. May 5th. (Cognate application, 14,484/15.)
7,211. Electric Circuit Controlling Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.). May 13th. (Addition to 16,327/14.)
7,316. Timing of Electric Ignition in Internal-combustion Engines. Thomas Transmission, Ltd., & J. G. P. Thomas. May 15th. (Addition to 2,245/15. Cognate application 7,934/15.)
7,647. Junction Boxes and the like for Electric Wiring Installations. G. S Boothroyd and Callender's Cable & Construction Co. May 21st.
8,543. Electric Welding and Brazing Apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 9th.
10,485. Electric Magnetic Recording Apparatus for Telegraph Circuits. R. W. James (A. H. Annand). July 19th.
16,900. Cables for the Distribution of Electrical Power. J. H. Bowden and H. F. J. Thompson. December 1st. (Divided application on 4,586/15 March 24th.)